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AN INSTANCE OF ELECTRICAL GROWTH.

An instructive case was brought to our notice recently which showed how readily electrical power is adopted when the choice is not influenced by an existing equipment of some other kind. A bad fire broke out in one of our large cities and destroyed completely the shops of a number of well-established industries. These companies immediately rebuilt and in every case, so far as we have been able to learn, adopted electric power. The old machinery was gone and there was a free choice in selecting the new, with the result mentioned. The electricity supply company was, of course, quick to realize the possibilities of the situation and although it lost heavily in custom at first, as many of its consumers were also burned out, it soon regained what it had lost and in a few months had increased its sales of power to over three times the former figure. Practically the same result took place in the lighting load, though the increase was not so marked. It should be added that there was active competition at the time, as the company referred to above was not alone in the field and no doubt its competitors also enjoyed a goodly increase in output also. "It's an ill wind that blows nobody good."

ECONOMY OF ELECTRIC PUMPING.

Pumping of water for the supply of cities and towns is a very desirable class of work for electric systems, where the reservoir capacity is such that the pumps can be kept in nearly constant operation at full load.

The desirable nature of this load is, of course, due to the fact that it can be carried by generating equipment which would otherwise be idle a great part of the time. If the electric system concerned operates in large part with water power, the work of pumping water supplies is especially attractive, because it can be done in a greater or less degree with water that would otherwise go to waste over the dam, between midnight and noon, on many days of a year. In view of these facts, electric systems are warranted in making very low rates for nearly continuous pumping service.

An interesting example of this sort is that in a large city where the electric company has taken the contract to pump 700 million gallons of water per month, under a head of 200 feet, at the rate of $4.50 per million gallons. This work is to be done with a pump that has a daily capacity of twenty-five million gallons, when operated twenty-four hours, and the pump must thus be kept in nearly constant service in order to raise 700 million gallons of water per month.

While 200 feet, including a lift of eighteen feet, is the maximum head against which the pumps have to work in this case, the head for a part of the service is as low as 133 feet, and the rate of $4.50 per million gallons pumped decreases directly with the head. Thus at 133.3 feet of head the rate is $3 per million gallons. As the weight of water is about 8.3 pounds per gallon, the work done in raising one million gallons against a head of 200 feet amounts to 1,660,000,000 foot-pounds. With the equivalent of 2,654,400 foot-pounds per kilowatt-hour, the work of raising one million gallons against a head of 200 feet reduces to 625.4 kilowatt-hours. With an efficiency of ninety per cent for the electric motor, and of eighty per cent for the centrifugal pump that is used for this work, or a combined efficiency of seventy-two per cent for both, the actual work done must amount to 868 kilowatt-hours per million gallons of water pumped. Dividing the sum of $4.50 paid per million gallons pumped by the number just found gives the rate of 0.518 cent per kilowatt-hour for the work.

As the motor with its connected pump has a capacity to raise twenty-five million gallons during each twenty-four hours, when working under a head of 200 feet, the capacity of the motor should be 723 horse-power, if the assumed efficiencies for the motor and pump are correct. When the motor and pump are operated continuously at full load during twenty-four hours, raising twenty-five million gallons of water under a head of 200 feet, the cost of electric energy consumed by the motor

will reach $112.50, on the basis just named. The equipment adopted for this pumping consists of a direct-connected motor and pump with vertical shaft. Current reaches the motor at 2,200 volts, twenty-five cycles, three-phase. Before the electric motor and centrifugal pumps were installed, an estimate was made of the total cost of pumping with electric and with steam power. The twenty-five million gallons per day to be raised by the new pump is merely an addition to the city supply, and the cost of pumping with steam power, as to merely operating expenses, was taken from the records of the pumping station for the fiscal year of 1903. During that year the quantity of water pumped by steam power was much greater than 700 million gallons per month, the rate at which the new pumps were to work. From the records of 1893, the cost of operation per million gallons of water pumped under a head of 200 feet was found to be $4.66. The estimated cost of additional steam pumps and boilers with a capacity of twenty-five million gallons daily was $137,500, and interest and depreciation on this sum at the rate of eight per cent yearly amount to $1.18 per million gallons. This brings the total cost of pumping water by steam power up to $5.84 per million gallons.

For the electrically driven pump the estimated cost was $35,000, and the combined annual interest and depreciation on this sum at eight per cent represent 30.7 cents per million gallons pumped. From the records of the steam-power pumping plant during 1903, it was found that the proportionate labor cost of operation for one pump in the engine room was $4,187.77 per year, and this sum represents 45.9 cents per million gallons with a pump of twenty-five million gallons daily capacity. Starting with the charge of $4.50 per million gallons of water, for electric energy to operate the motor, the labor charge in the engine room and the sum of interest and depreciation, bring the entire cost of electric pumping up to $5.27 per million gallons. Comparing this sum with the cost of $5.84 per million gallons pumped with steam power, it seems that the use of electric energy for pumping effects a saving in this case of fifty-seven cents per million gallons. On the basis of 700 million gallons of water per month, this saving in the cost of pumping amounts to $4,788 yearly, if all the work is done under the head of 200 feet. At lower heads the saving in favor of electric pumping is still greater per million gallons, because the energy rate for the electric pumping drops in direct proportion to the head, and the greater fixed charge against the steam-power plant remains constant.

The cost of coal at the pumping station in question was $2.13 per ton during the year of 1903, and the consumption amounted to 1.32 tons per million gallons of water pumped, when reduced to a uniform head of 200 feet. The total cost of coal including the cost of handling it and caring for the boilers, without any allowance for the time of the engineers, was $3 per ton, or about $4 per million gallons of water pumped under a head of 200 feet. In the computation of these comparative costs, the electric pump was charged as much as a steam pump for attendance in the engine room, but as a matter of fact the advantage in this regard would be with the electric equipment. The cost of $2.13 per ton for delivered coal in this case is below that in many places, and with higher prices for coal the saving of electric pumping at the rate named would be still greater.

THE NATIONAL ELECTRICAL CODE.

At a recent convention of the National Electrical Contractors' Association of the United States, President Ernest McCleary made an eloquent appeal for a uniform interpretation of the rules formulated by committees from the various engineering and insurance underwriting societies interested and promulgated by the National Board of Fire Underwriters as the National Electrical Code. This code sets forth rules by which the electrical contractor is to be guided in the installation of current-carrying and kindred appliances. The National Electrical Code is a splendid proposition. Mr. McCleary had no criticism to make upon the rules by and large, but it was the individual interpretation of these rules by local authorities that was creating, and would continue to create, havoc among the manufacturing and contracting interests of the country.

The National Electrical Contractors' Association, supplemented by the efforts of the manufacturers of electrical apparatus, has brought into being a manufactured product that for excellence of design and stability of construction is not excelled anywhere in the world. The recent exhibition in Mechanics' Hall, Boston, Mass., gave evidence that the manufacturers and contractors were one in their endeavors to secure apparatus which would amply comply with the most rigid requirements of a most rigid inspection bureau.

The whole scheme of inspection by the National Board of Fire Underwriters, and the provision of the National Electrical Code, is to reduce as greatly as possible the fire risk of an electric installation, but the enforcement of these rules must come from the centralized bureau, and the interpretation of these rules must be uniform from Maine to Texas and from New York to California.

Electrical apparatus constructed to-day and approved as National Electrical Code standard can not be made to fit the individual requirements of local underwriting concerns. The distribution of apparatus, no matter where manufactured, covers the whole country, and the field of the electrical contractor must not be limited by the boundaries of his city or state.

President McCleary made the significant statement that the time had come when the electrical contractors must say to the fire underwriters: "You must enforce these rules or withdraw from the field and leave it to men who will enforce them. We believe that they should exercise authority; if they can not, they have no right to legislate."

Now there must be rules, and these rules must be enforced. If the condition should come about that the rules were not under the jurisdiction of some powerful body, and the individual were to install electrical apparatus to suit an inexpert judgment of the fire hazard, certainly electrical contracting would deteriorate from its present high standard. Neither President McCleary nor any other good electrical contractor desires such a state of affairs, but he voices a sentiment that is not new, but is

taking a deeper root day by day, that local underwriting authorities cease to interfere with the rules laid down by the National Board of Fire Underwriters and expounded in the National Electrical Code, and that local inspectors key their interpretations of these rules according to the standard of the centralized bureau of reference.

THE BUSINESS OF OPERATING TELEPHONES.

The ELECTRICAL REVIEW is pleased to publish on other pages in this issue copious extracts from the report made by the Merchants' Association of this city on the question of telephone service and rates of the New York Telephone Company. This presentation comprises so much good common sense and interesting and accurate data, that we have allowed it more than usual space. The public has never realized the great expense, the unusual technical ability and far-seeing intelligence necessary to successfully cope with this modern industry in all its vast, intricate and sensitive ramifications. The demand for the telephone came upon us after its advantages and utilities became moderately known with whirlwind rapidity and volume. This is well exemplified by the increase in this city shown in the statistics we publish of from 12,000 subscribers to the telephone system some fifteen years ago compared with the 150,000 stations now in use, with a constant proportionate growth always to be provided for.

The report shows, among other interesting things, that the management of the New York Telephone Company is a broad and liberal one, and that the public receives the benefit of improvements in service as rapidly as practical changes can be made, and reductions in rates when proper regard for the interests of such progressive service will permit it.

We believe such publicity as this respecting the telephone industry in general can not but prove of great value to telephone interests, and we believe the public, if it gives proper weight to these unprejudiced statements, will cease the criticism of telephone charges which has been prevalent in the past through ignorance of the conditions surrounding the service.

FIRE-ALARM TELEGRAPHS IN NEW YORK CITY.

The wave of agitation in favor of municipal ownership of public utilities that has recently swept over the country has brought to light many interesting facts in relation to the maintenance of these utilities. In many cases the most important factor in the division of earnings is the sum that must be laid aside to provide for keeping the system not only equipped with modern apparatus, but in a fairly workable condition. In large cities, where the power-producing stations are loaded heavily, and each piece of apparatus is worked to its maximum capacity, the life of any machine is considerably shorter than the average citizen imagines.

In New York city, within very recent years, the whole scheme of transportation has changed about. Horse-cars have given way to cable haul, and the cable haul has given way to electric traction. The systems for transmission for light and power have been changed over several times and work is continually going on to create economies and establish certainty of service. The telephone system has been entirely changed from the local battery to the central energy system, and ninety-five per cent of telephone distribution is underground.

These utilities are all controlled by private corporations. What is the condition of affairs with our municipally controlled fire-alarm telegraphs? We have been waiting patiently for an investigation and an announcement that this system would be overhauled. From time to time one hears that the system is badly in need of rehabilitation. Certainly this great city is worthy of the most modern fire-alarm telegraph. No private corporation would attempt to do service with an antiquated system, and the fire department of the city of New York should not be handicapped by any defects in its lines of communication. We do not wish to cause any undue anxiety as to the general reliability of the fire-alarm telegraph service as it exists to-day in New York city, but we should be glad if some one would tell us that steps were being taken to thoroughly overhaul the system and put it on a modern basis.

A USEFUL ELECTRIC FURNACE.

As has so frequently been stated, the electric furnace does not, as a rule, base its claims for recognition on a reduction in the cost of heating. In general, the cost of the electrical energy which is converted into heat is greater than would be the cost of an equal amount of heat energy obtained directly from coal. But in most problems two factors must be considered. The temperature of the furnace is just as important as the quantity of heat, and the control of the former may be the governing factor.

A very pretty illustration of this is the electrical combustion furnace devised by Professor H. W. Morse, of the Johns Hopkins University. The combustion furnace, as usually used in the chemical laboratory, consists of a porcelain tube heated externally by gas flames and through which the gases to be burned are passed. This type of furnace is inefficient, a matter of little importance, but the life of the tube is short, generally lasting for but one determination, and this is a more serious consideration. Professor Morse has avoided this by constructing a simple, cheap and yet effective furnace out of materials to be found in every chemical laboratory. He winds a fine platinum wire over the porcelain combustion tube and encloses the heating element thus formed in a larger glass tube. The platinum spiral is heated by an electric current. The gases to be burned are passed in through the porcelain tube and returning around it are heated by the hot wire. The furnace is easy to manipulate, perfect in its action and the operation is quickly performed. The platinum wire lasts a long time and the porcelain tube, indefinitely. The furnace not only does its work better than the old type, but is less expensive both as regards the construction and operation, as there is no destruction of its parts, and the efficient method of heating makes the cost of the electrical energy less than that of the gas for the old process. The up-to-date chemist is learning to adopt electrical methods for facilitating work and lightening labor.

An Industrial Water-Power Plant at South Bend, Ind.

FOR a number of years several industries have derived their power from the St. Joseph river at South Bend, Ind. At this point the water is backed up by a dam and distributed among numerous users through two head-races, one at either side of the river, and extending for a distance down-stream from the dam. One of the oldest industries of this part of the country is the Oliver Chilled Plow Works at South Bend. The Oliver interests, however, include, in addition to the plow works, a hotel in the business district and a theatre adjacent. The works of the Oliver company are nearly two miles from the river, and up to the present time have not utilized any water power for their service. The abandoning of several smaller industries located along the west race, and the foresight of Mr. James Oliver, the leading figure in the Oliver interests, made possible the securing of valuable rights on the south half of the St. Joseph river at the fall opposite the foot of East Washington street. The city uses a part of this flow for its water-works, and the remainder is under the control of the Oliver company. Fig. 1 shows the power-house with the forebay drained by a temporary coffer dam. The intake channel, forebay and power-house, along with the discharge race, are of new construction, the entire structural work being of reenforced concrete. It might be well to emphasize the exception that the power-house building is constructed of hollow concrete blocks. Fig. 2 shows the waste gates for controlling the water level in the forebay.

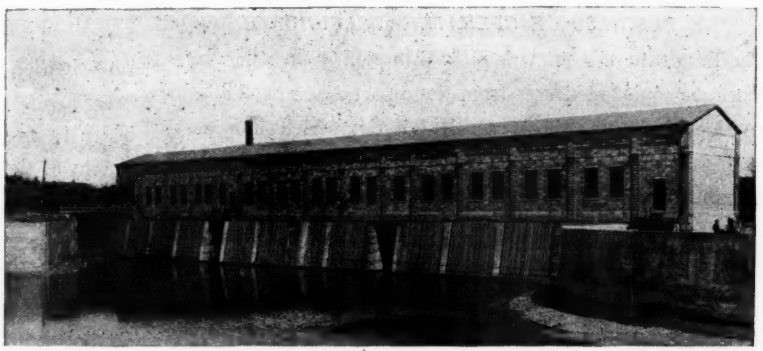


FIG. 1.—POWER-HOUSE, WITH FOREBAY DRAINED BY TEMPORARY COFFER DAM.

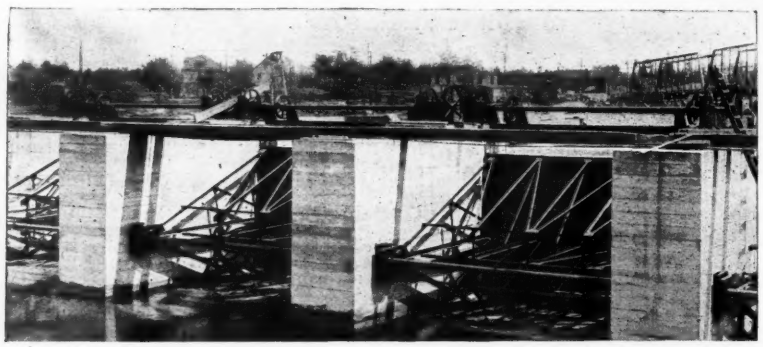


FIG. 2.—WASTE GATES FOR CONTROLLING LEVEL OF WATER IN FOREBAY.

The original coffer dam was at the upper end of the intake. The improvement now put in place was free of water except that which backed up from the tail-race. The power building is divided into three portions, accommodating the three generating units installed inside. At the lower end of the forebay the tunnel turns at a right angle and discharges into the wheel-pits of the power-house through iron gratings. There are in all twelve wheel-pits, each generator being supplied by four wheels. The wheels were built by James Leffel & Company, Springfield, Ohio. They are sixty-eight inches in diameter, of the vertical Samson turbine type, and develop 350 horse-power each at seventy-five revolutions per minute. The operation of the four water-wheels of each unit is controlled by a Lombard governor. The governing arrangements are somewhat unusual. Water-wheel gates are ordinarily operated through suitable gearing from a rotating shaft under control of the governor. In the present case the four gate shafts are connected, not by a rotating shaft, but by a continuous bar which is moved longitudinally through gates under control of a pinion actuated by the governor, and meshing into a rack attached to the bar. Each gate shaft is rotated by a suitable rack meshing into a segment gear keyed to the gate shaft. This arrangement allows the governor to

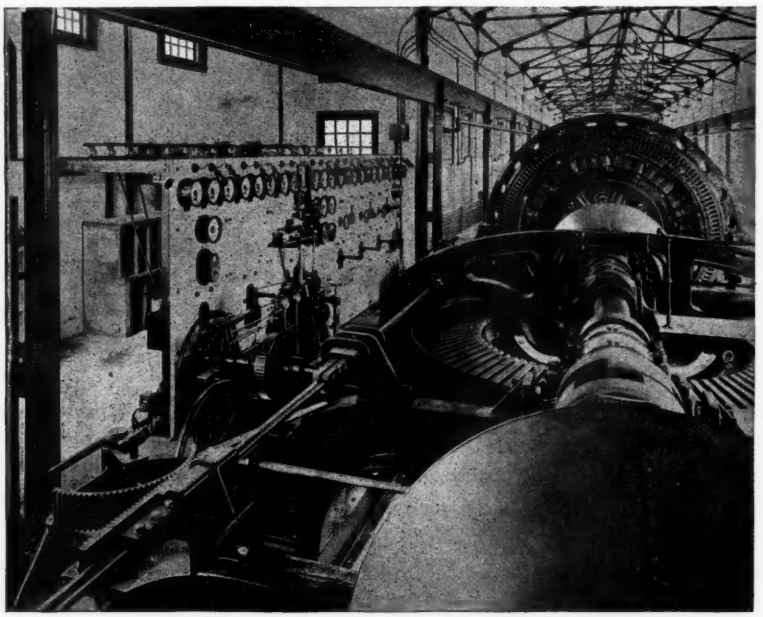


FIG. 3.—VIEW SHOWING SWITCHBOARD, GOVERNOR, AND HARNESS DETAILS.

be placed in a longitudinal position. It economizes space, and provides also a positive connection between the governor and the several gate valves. The mounting and application of the governor are shown in Fig. 3.

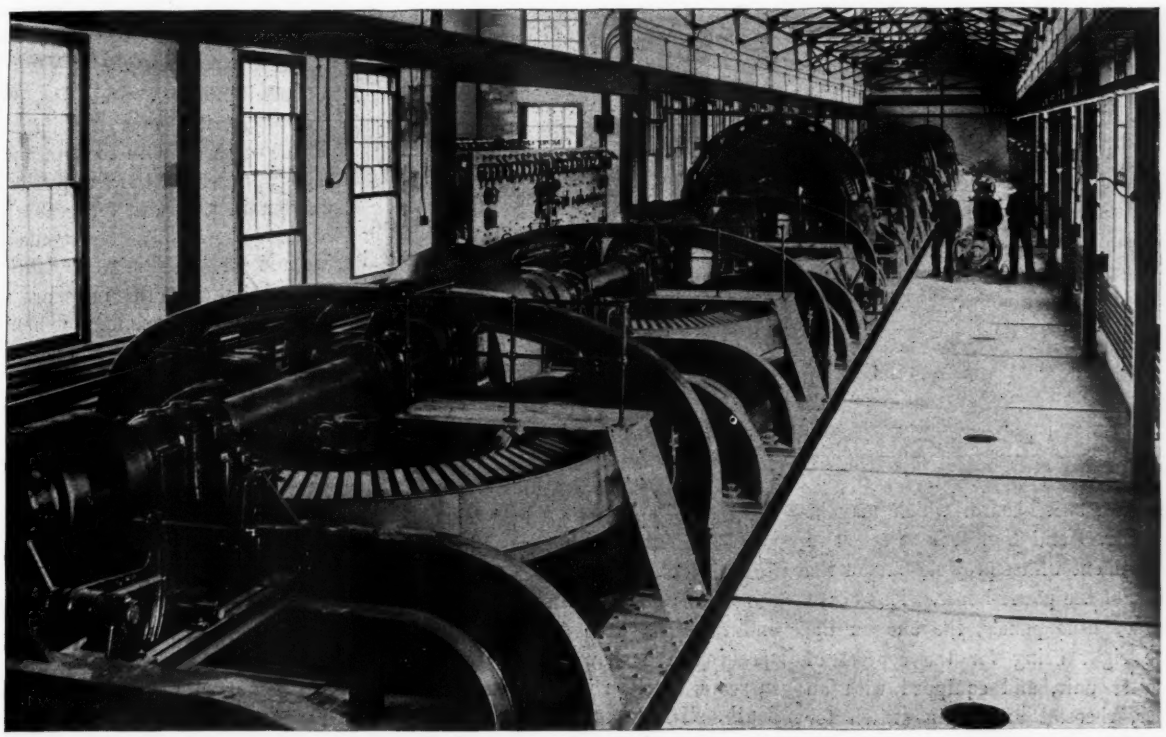


FIG. 4.—THE HARNESS FOR THE COMPLETE UNITS IN THE POWER-HOUSE OF THE OLIVER CHILLED PLOW COMPANY, SOUTH BEND, IND.

The driving connection between the water-wheels and the generator is provided by an installation of heavy harness and shafting equipment supplied by the Dodge Manufacturing Company, of Mishawaka, Ind. The assembly of the harness for the complete units driving three 500-kilowatt Westinghouse generators is shown in Fig. 4. The vertical shaft for each water-wheel is eight inches in diameter, and is made in two sections. The upper section is bossed to receive the hub of a mortise crown gear. Male and female flange couplings join the two sections of each vertical shaft and form a rigid connection with the turbine shaft. The upper section of the vertical shaft runs in self-oiling bearings, one above and one below the hub of the crown gear. The lower of these bearings is attached to a cross-tree beneath the gear, while the upper bearings are bolted securely to the main yoke casting. This casting is made in a peculiar form for this purpose.

The variation of the number of wheels in use with any generator, according to the load to be carried, is effected by the manipulation of jaw clutches between successive sections of the main shaft. If the load to be carried requires the use of two wheels, the two wheels nearest to the generator would naturally be used, and the other two disengaged by opening the jaw clutch. These clutches are of cast steel, and are operated by geared shifters through hand-wheels. For each shaft section a ball-bearing thrust collar is provided, placed in front of the main bearing above the crown wheel.

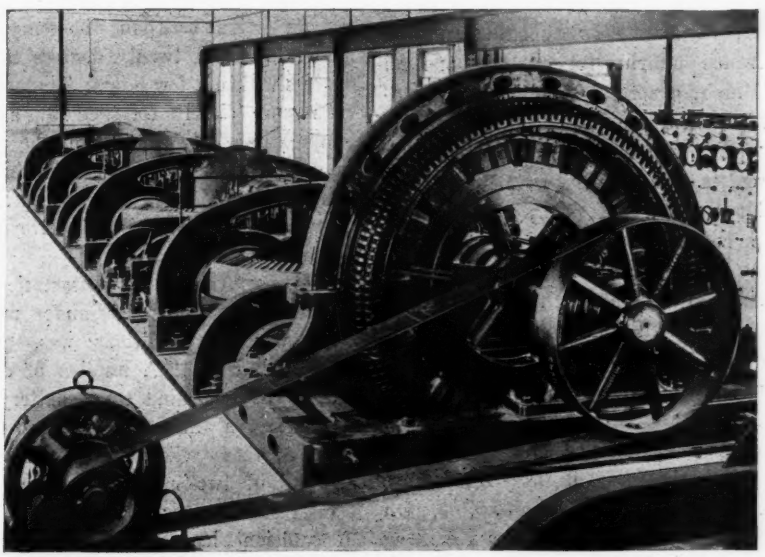


FIG. 5.—ONE COMPLETE UNIT, FOR WATER-WHEELS AND A 500-KILOWATT WESTINGHOUSE ALTERNATOR.

The water-wheel harness as a whole is supported by the steel construction forming the power-house floor. Girders extend longitudinally at either side, and to these are bolted the cross-trees and yokes supporting the moving machinery. Intermediate bearings, one at each end of each shaft section adjacent to the jaw clutches, are carried by plain yokes, while the main yokes serve the double purpose of supporting the horizontal shaft bearings immediately in front of the pinions, and of carrying the upper vertical bearings for

the wheel shafts. These yokes and bridge-trees are of extensive proportions, each yoke weighing about 4,800 pounds. The total shipping weight of all machinery supplied by the Dodge Manufacturing Company amounted to nearly 600,000 pounds, including the longitudinal steel girders to which the yokes and cross-trees are bolted, and the machinery from the couplings immediately above the wheels to the couplings between the main shafts and the generators. Fig. 5 is a view in the engine room showing the general arrangement of water-wheels, the harness and the generator for one power unit.

The generating equipment consists of three 500-kilowatt three-phase alternators. Current is generated at 6,600 volts, twenty-five cycles. Each generator has a twenty-kilowatt exciter belted to it, furnishing direct current at 125 volts. The electrical apparatus was installed by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

The main switchboard, which may be seen in Fig. 3 and Fig. 4, is installed in a compartment which projects out on the river side of the power-house. This board consists of nine panels, the one on the extreme right being for the control of the exciter unit, and equipped with an ammeter, rheostat and main switch for each exciter, and a common voltmeter for all of the exciters. The rheostats for the main generators are mounted on the wall back of the switchboard, and are controlled by rheostat handles, one on each main generator panel. Three generator panels are provided; each being equipped with an ammeter for alternating current, a direct-current ammeter for the field current, a wattmeter, synchronizing lamp, voltmeter plug, field switch and main switch. An instrument panel is provided in the centre of the board, which is equipped with an ammeter for each phase, a power-factor meter, a totalizing wattmeter, frequency meter, recording wattmeter, and static ground detectors. Three feeder panels are placed at the left end of the board. On two of these are mounted ammeters and an oil switch. On the third there are mounted a recording wattmeter, indicating wattmeter, an oil switch, and the corresponding ammeters. The switchboard is built up of gray Vermont marble, fastened to angle-iron frames. The high-tension wires are mounted on petticoat insulators, supported on iron pins. The low-tension wires are mounted on ordinary porcelain insulators, or are carried directly on the marble of the board.

Current is transmitted at 6,600 volts, three-phase, through conduits beneath the city streets to the Oliver factory plant and to the hotel. At the hotel current is transformed and the voltage lowered to supply the direct-current system now in vogue. The factory will be supplied with low-voltage three-phase current for driving induction motors.—*Power and Transmission, June.*

Performance of Automatic Block Signals under Unfavorable Conditions.

Mr. H. S. Balliet, engineer of maintenance of way of the New York Central & Hudson River Railroad, has published in book form an article entitled "Performance of Automatic Block Signals under Unfavorable Conditions." This is reprinted from the *Railroad Gazette*. The article discusses the service of automatic block signals during the winter of 1903-1904. The principal railroads which have in service automatic block signals reported that the weather conditions during January, 1904, were the most severe since the signals had been in use. Snowstorms and blizzards were frequent. Generally speaking, the snowfall was the heaviest in years, fourteen inches being a common depth. The thermometer on the coldest days recorded from zero to forty degrees Fahrenheit below. The period of extreme cold lasted about thirty hours each time, and on several occasions the temperature moderated from twenty degrees to forty degrees within a few hours. These sudden rises were closely followed by a lower temperature. In one case the record shows forty degrees decline within five hours. This decline occurred after the thermometer registered thirty-five degrees above zero.

The performance of automatic block signals, the author states, under such adverse weather conditions was, on the whole, admirable. A number of cells of gravity or bluestone track battery were found frozen into a solid mass of ice. Most of these cells were in chutes constructed of two-inch lumber, and about eight feet in depth; or in cast-iron chutes of sufficient length so as to bring the lower cell about seven feet below the surface of the ground. Careful inspection indicated that most of these cells were frozen in consequence of the improper filling in of earth when the chutes were set.

The article details the best methods of procedure in installing track batteries and circuits. The effect of frost in wood and iron enclosures is described, and emphasis is laid upon the care necessary for the complete protection of every part of the working apparatus. Relays and their enclosures are treated in detail, illustrations being given; and the operating and controlling mechanisms are fully described.

Electric Supply of Dublin.

United States Consul Moe, of Dublin, Ireland, writes that the lighting committee of the Dublin corporation issued a report in which they recommend a reduction in the rates for general lighting and for the supply of currents for heating and for motive power. In the case of general lighting, the rates are to be reduced on the maximum demand system from fourteen cents and five cents to twelve cents and five cents. The committee do not recommend any reduction in the twelve-cent flat rate, as in Dublin there is an undue proportion of offices and early closing shops which only use the current from four to five months in the year, and are not profitable even at the rate of twelve cents.

For motors and heating currents the rates are to be reduced from fourteen cents and two cents to eight cents and two cents, with an alternative flat rate of five cents per unit. The committee report a "steady increase" in the demand for motor currents, though "too small to be satisfactory day load even for Dublin." They are completing an arrangement with one of the largest firms of motor manufacturers in the world for the adoption of a system of hire-purchase, under which motors will be supplied at very reasonable rates on the three-year instalment plan. They believe this will satisfactorily affect the demand for power.

Flat rates per unit are recommended for certain consumers who use current for a considerable number of hours each day.

No concession is made to concert halls and other similar places of amusement, to "temporary buildings," or permanent buildings for "temporary purposes," or to churches and buildings attached thereto.

Albert Medal for Lord Rayleigh.

The Albert medal of the Society of Arts for 1905 was presented on July 5 to Lord Rayleigh "in recognition of the influence which his researches, directed to the increase of scientific knowledge, have had upon industrial progress, by facilitating, among other scientific applications, the provision of accurate electrical standards, the production of improved lenses, and the development of apparatus for sound signaling at sea."

The Clyde Valley Electrical Power Company, Limited.

FOR many years the Clyde and the neighboring district has been famed as a centre of high industrial and engineering importance; and it is the avowed object of the Clyde Valley Electrical Power Company, which was initiated by local enterprise, to help manufacturers in the district surrounding Glasgow to maintain the position they have so long held in the first line, and to aid them in competing as keenly as ever in the world's markets. The company was incorporated in 1901, and has obtained powers over an area extending along the Clyde valley from Craigdoran and Port Glasgow on the west, to Lanark and Shotts on the east. This area, which comprises about 750 square miles, contains the most important manufacturing and coal-producing district in Scotland.

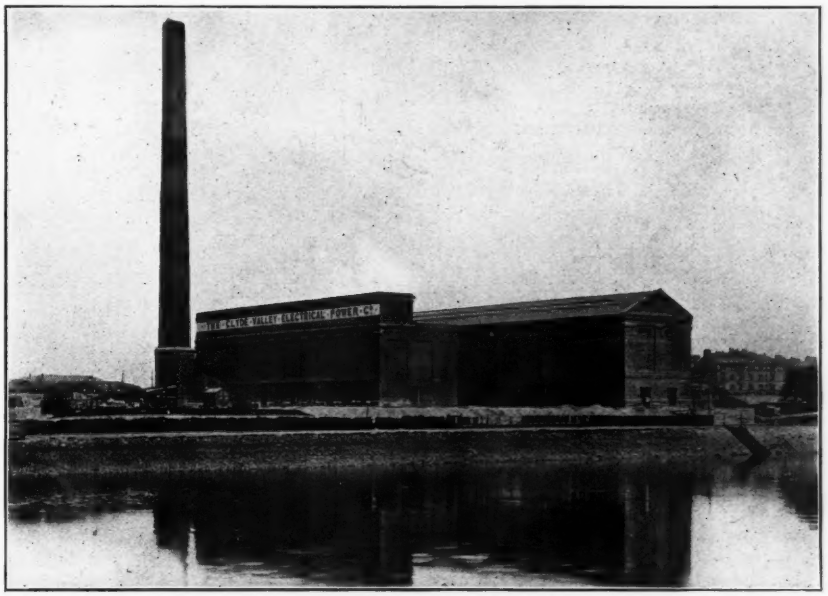
The company has taken over the provisional order which was granted to the burgh of Clydebank in 1901. This was sanctioned by Parliament in 1904, and enables the company now to supply electricity for both power and lighting in the burgh, for which purpose a special plant has been installed.

The city of Glasgow, and the burghs of Govan, Partick, Port Glasgow, Paisley and Hamilton, although actually situated in the above area, are not included in the company's schedule unless any of them should elect to take a supply.

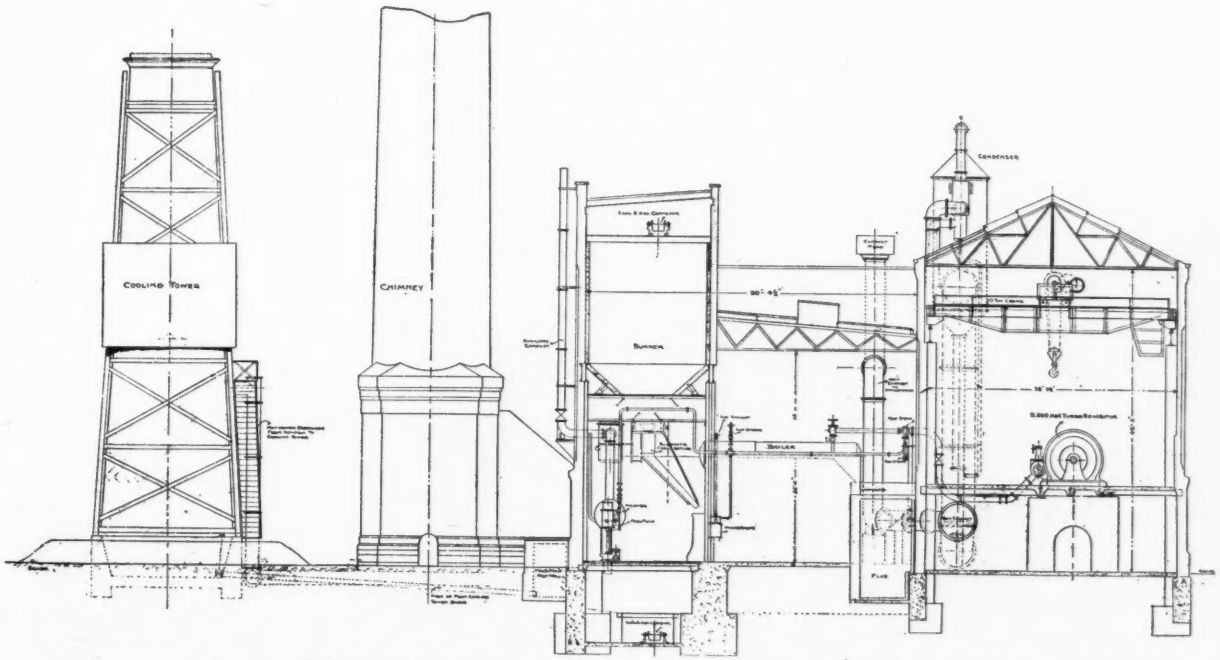
Under its act of Parliament the company was empowered to acquire land for the erection of generating stations at Yoker and Motherwell, five miles and fifteen miles out of Glasgow respectively; and in September, 1902, a contract was entered into with the British Westinghouse Electric and Manufacturing Company for the erection and equipment of these two stations and the various substations that are dotted over the area.

YOKER POWER STATION.

The Yoker generating station is situated on the banks of the Clyde, where an unfailing supply of water for condensing purposes is available. The Motherwell station being situated at a higher elevation, and above the level of



YOKER POWER STATION OF THE CLYDE VALLEY ELECTRICAL POWER COMPANY.



CROSS-SECTION OF THE MOTHERWELL POWER STATION OF THE CLYDE VALLEY ELECTRICAL POWER COMPANY.

the river Clyde, depends for its water supply for condensing purposes on electric pumps working against a head of 140 feet.

The offices occupy part of the south end of the engine room, being placed adjacent to the switchboard galleries. Accommodation is provided here for the station superintendent, storekeepers, and timekeepers. The offices are divided off from the switch galleries by iron doors, and everything is of a thoroughly fireproof construction, special attention having been paid to this important matter.

BOILER HOUSE.

The boiler house has an internal measurement of 186 feet long by fifty feet wide. It is well lighted and is designed in every way to afford the maximum of convenience.

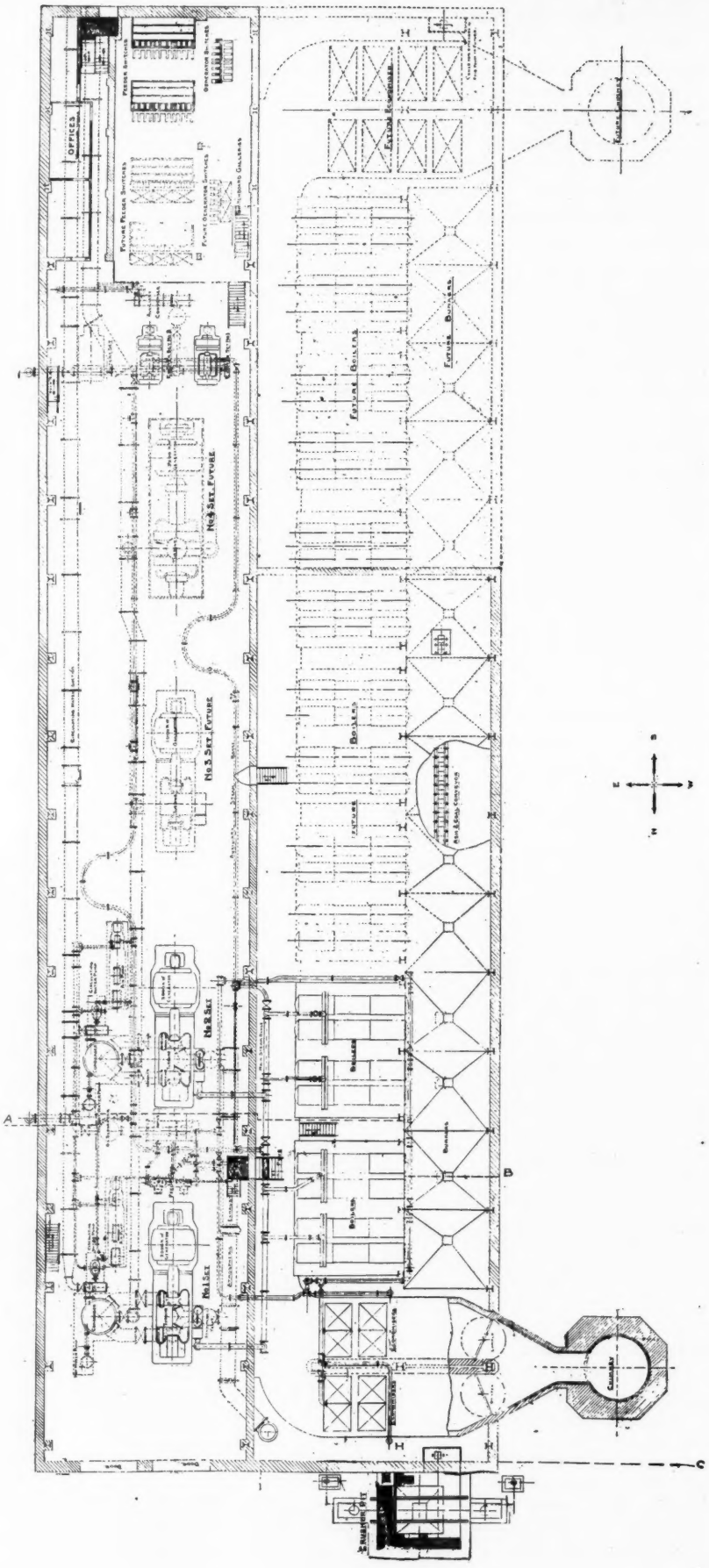
There are at present four double-drum Babcock & Wilcox water-tube boilers in position; each having a heating surface of 4,400 square feet and fitted with superheaters capable of imparting 150 degrees Fahrenheit of superheat. The steam pressure is 175 pounds per square inch. The boilers are connected to a main flue passing along the back, and a Green's economizer of two sections and 432 ten-foot tubes is installed between this flue and the chimney, the usual by-pass flue being provided.

The chimney is built of special perforated and moulded bricks on the Alphons Custodis system, and is 225 feet high above the foundations with an internal diameter at the top and bottom of eleven and fourteen feet respectively.

It is lined with firebricks up to a height of eighty-five feet above the top of the foundations, which extend to a depth in the ground of twenty-two feet. The base of the foundation occupies a space of 2,116 square feet, and the weight divided over the entire area is two tons per square foot, allowance being made for wind pressure.

Each of the boilers is fitted with a Roney mechanical stoker, manufactured by the British Westinghouse Company, and adapted for burning efficiently a cheap class of coal. These are driven through special worm gearing by two four and one-half-inch by four-inch, five-horse-power Westinghouse standard engines, running at 400 revolutions per minute and situated in the boiler house.

The coaling arrangements of the power station are most complete, and from start to finish the fuel is untouched by hand. Coal is brought in wagons to the company's private siding, where it is dumped



General Plan of Yoker Station of the Clyde Valley Electrical Power Company.

by a hydraulic ram into the crusher pit, passing through a crusher and screen operated by a ten-horse-power, enclosed, shunt motor running at 650 revolutions per minute. It is there picked up by a bucket conveyer, constructed by Messrs. Graham, Morton & Company, and carried to the storage bunkers over the boiler house. This conveyer, which is driven by a fifteen-horse-power, enclosed, shunt-wound motor, is also used for carrying the ashes away from the boiler house.

From the bunkers the coal passes automatically to the stokers; being weighed—also automatically—in transit, and the number of hundredweights used recorded on an indicator. To prevent the coal sticking in the shoots a motor-operated agitator is installed, which keeps it constantly on the move.

ENGINE ROOM.

The engine room consists of two floors, one on the ground level, and one in the basement, the latter containing most of the auxiliary machinery. The turbine condensers, which are of the Mirrlees Watson vertical surface type, each with 6,250 square feet of cooling surface, are placed here, their upper ends projecting through the main floor a few feet. Each turbine exhausts directly into its own condenser, and each condenser is provided with a steam-driven, two-stage, dry air-pump situated in the basement. Arrangements have also been made for exhausting to atmosphere if necessary.

The circulating water for the condensers is drawn from the Clyde, running by gravity into a large circular well eighteen feet in diameter and of a depth below water level of nine feet. There are two thirty-inch pipes leading into the well from the river, and the water is drawn out through a thirty-six-inch cast-iron pipe by means of a steam-driven centrifugal pump placed in the basement.

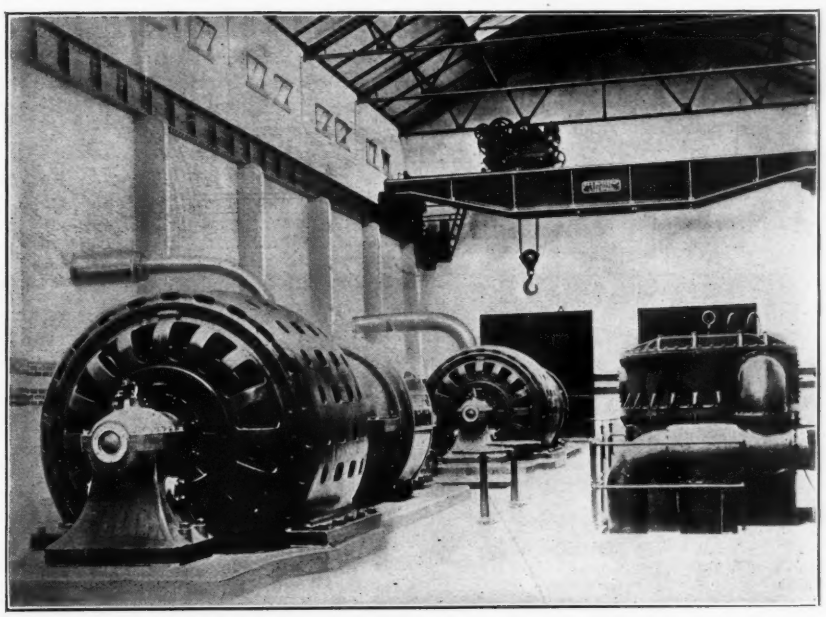
After passing through the condensers the water is discharged by a thirty-six-inch pipe into a tank on the bank of the river. The condensed water is pumped into the hotwell, which is also in the basement, by a centrifugal pump driven by a six-horse-power, vertical shaft, shunt-wound motor running at 625 revolutions per minute. From here it passes to the suction of the two feed pumps, which are of Messrs. J. & P. Hall & Sons' tandem-compound, double-acting type, each capable of delivering 9,600 gallons per hour against a boiler pressure of 175 pounds. The make-up water is taken from the city mains, that of the Clyde being unsuitable for boiler feed purposes; there is, however, a stand-by suction from the river for use in case of emergency.

The exciter sets have their separate surface condenser which is of the Worthington Pump Company's make, and has 600 square feet of cooling surface.

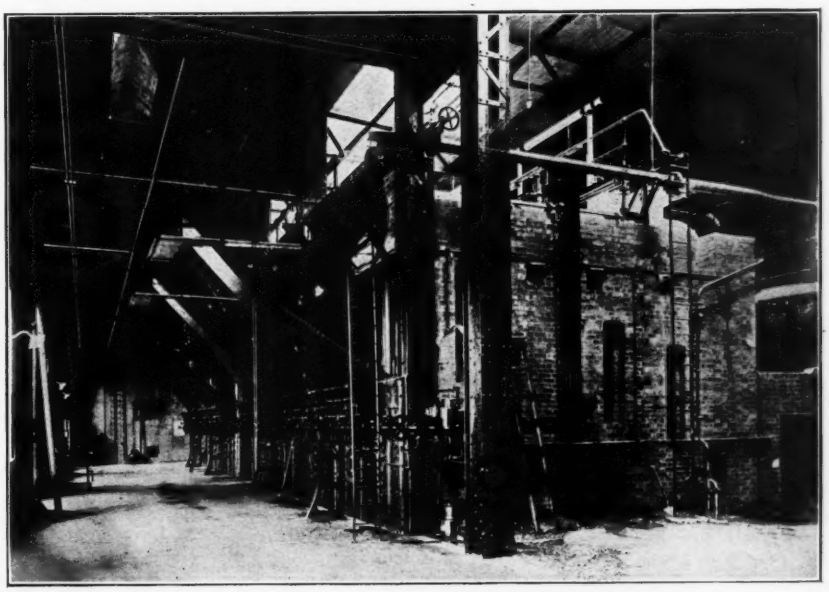
In addition to the above auxiliary plant there is installed a feed-water heater by Messrs. Joseph Wright & Company, having a heating surface of 700 square feet.

GENERATING PLANT.

The upper and principal floor of the engine room measures 252 feet long by forty-three feet five and one-half inches wide. It is well lighted from the roof, the walls are faced with white glazed bricks, and the floor throughout is paved with Italian mosaic work. At the north end are situated the switchboard galleries and offices, which have an inside measurement of fifty-three feet by forty-three feet one inch wide.



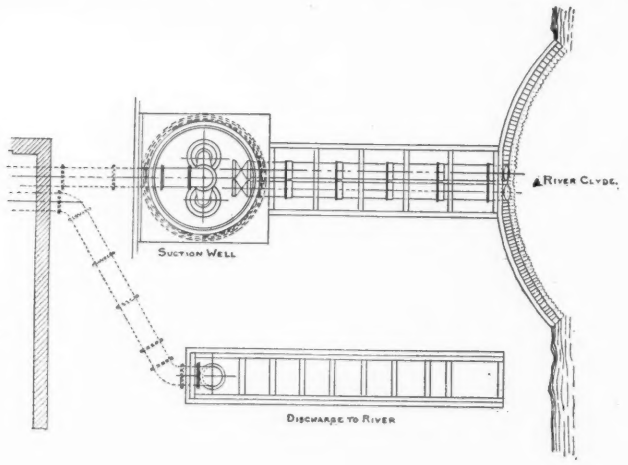
2,000-KILOWATT TURBO-ALTERNATOR GENERATOR END, CLYDE VALLEY ELECTRICAL POWER COMPANY.



BOILER HOUSE, CLYDE VALLEY ELECTRICAL POWER COMPANY.

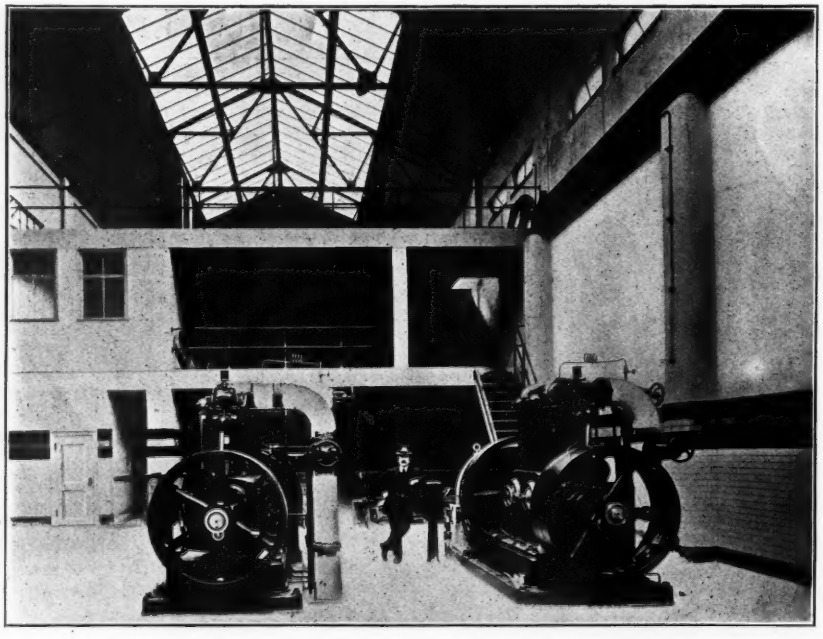
The main generating plant at present installed consists of two Westinghouse-Parsons steam turbine units, each with a normal capacity of 2,000 kilowatts and an overload capacity of 3,000 kilowatts.

The speed is 1,500 revolutions per minute, which corresponds to a peripheral velocity of the rotating part of five miles per minute. The turbines are of the latest double flow pattern, steam entering at the centre and exhausting at both ends, and



Suction Well and Discharge to River, Circulating Water, Yoker Power Station of the Clyde Valley Electrical Power Company.

each contains no less than 20,000 blades. These are securely fixed to the steel drum and are of drop-forged steel in the first series, and special metal at the low pressure end so as to prevent corrosion due to the wetness of the steam. The cylinder is



Exciter Sets, Clyde Valley Electrical Power Company.

of close-grained cast iron, and the rotor consists of a rolled-steel drum fixed to the shaft by the aid of forged-steel umbrella-shaped discs shrunk into the drum and pressed on the shaft.

Each of the turbines is directly connected to a Westinghouse 2,000-kilowatt, 11,000-volt, three-phase, twenty-five-cycle generator of the rotating field-type.

These are of the normal Westinghouse design; the two-pole field magnets consist of a solid forging of Whitworth pressed steel combining high magnetic properties with strength, and the armature of laminated iron wound with copper bars in practically closed slots is supported by a heavy cast-iron frame divided horizontally.

The starting, stopping and speed variations of the generators are under control from the switchboards by electrical means, current for these purposes being taken from the exciters.

The oiling of the turbines is carried out on the gravity system. A large tank in the basement of the engine room receives the oil overflowing from the bearings, which is then passed through coolers and raised by a special oil pump to a tank in the roof of the boiler house, flowing from thence by gravity under a head of fifty feet back to the bearings. Oil pressure gauges are provided on the latter in order to indicate at a glance how the apparatus is working.

The engine room as at present constructed will accommodate one more 2,000-kilowatt set and a fourth unit of 3,500 kilowatts, which will eventually make the total capacity of the station 9,500 kilowatts. The additional sets will be added as soon as one of the present units is loaded up, so that there will be always one spare ready at any moment in case of accident.

EXCITERS.

The two exciter sets, situated at the south end of the engine room, are each capable of furnishing the exciting current for both the main generating units at present installed. They are of seventy-five kilowatts capacity each, and consist of a Westinghouse eleven-inch by nineteen-inch by eleven-inch vertical, compound engine running at 290 revolutions per minute, coupled direct to a 125-volt, compound-wound dynamo.

In addition to their natural function these exciters supply current for operating the motors of the coal and ash-conveyer, crushers, agitators, economizers, pumps, traveling crane, etc., and also for the electrically operated main and other switches.

TRAVELING CRANE.

The traveling crane is by Messrs. C. & A. Musker & Company, and in the case of Yoker has a span of forty-two feet. It is of thirty tons capacity, of the three-motor type, these being of the Westinghouse type SB, totally enclosed pattern, series wound. The motors are of the following horse-powers and speeds:

Lifting, twenty-five horse-power, 460 revolutions per minute.

Longitudinal travel, ten horse-power, 650 revolutions per minute.

Transverse travel, four horse-power, 935 revolutions per minute.

SWITCH GEAR.

The whole of the switch gear is contained in the three galleries at the south end of the engine room. That on the ground floor and the first gallery are devoted to the oil switches and feeders.

On the third or top gallery of the switchboard are placed the main bus-bars

in the brick compartments and the main controlling board as well as resistances, etc. Following the latest practice, the control board consists of a small desk directly facing the various instruments such as ammeters, voltmeters, power-factor indicators, relays, etc.

All the main switches and smaller gear are electrically operated from this desk by the exciter current, as before mentioned, and the speed of the turbo-generators and their starting and stopping are also controlled from here.

seventy-three feet high, and is constructed entirely of wood thoroughly soaked in carbolineum of the best quality. The tower has a normal capacity for cooling 220,000 gallons of water per hour from 120 degrees Fahrenheit to eighty degrees Fahrenheit, when the temperature of the air is seventy degrees Fahrenheit or less; and the amount evaporated under ordinary conditions of atmospheric temperature does not exceed two and one-half per cent of the water circulated.

The condensing plant is another of the features in which the Motherwell station differs from Yoker, a barometric jet con-

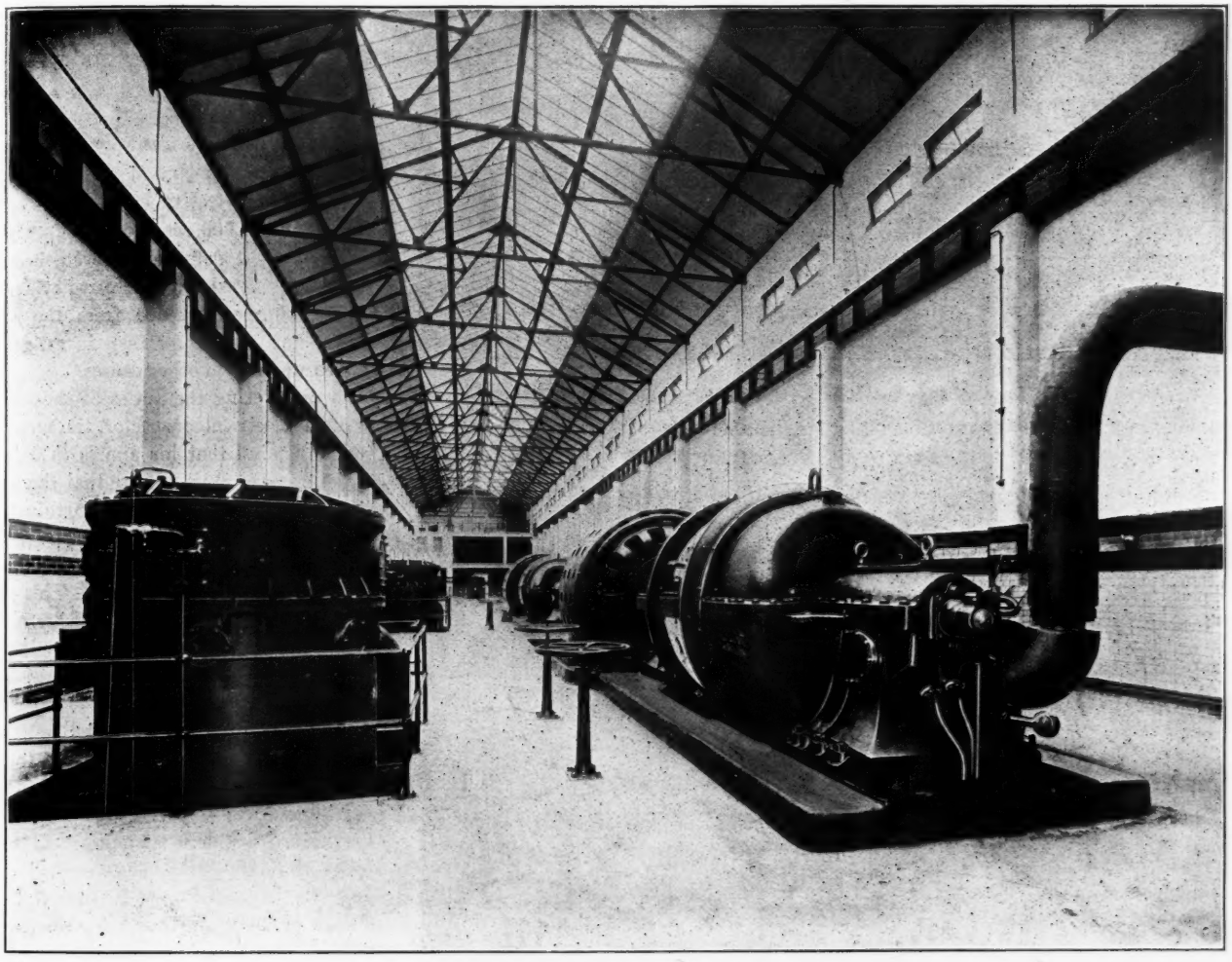
diameter of air cylinder, twenty-four inches; stroke, twenty-four inches.

Their normal speed is 100 revolutions per minute, but they are capable of working at a lower rate if necessary. The steam and exhaust valves are of the Corliss type, and so designed as to permit of a high speed in case of emergency without noise or jar.

DISTRIBUTION.

Six feeders are provided for distribution from Yoker, and all are protected when they enter the building in the basement by Westinghouse lightning arresters.

The cables for supplying power to any



General View of Engine Room, Clyde Valley Electrical Power Company.

MOTHERWELL GENERATING STATION.

The Yoker and Motherwell power stations are of the same size and almost identical in arrangement; the foregoing description therefore applies generally to both, with the following exceptions:

The Motherwell station is not so favorably placed as Yoker, being 400 yards from and 140 feet above the level of the river. A cooling tower of Messrs. Balcke & Company's make has therefore been installed for cooling the circulating water. It is of the natural draft enclosed type,

denser being installed. This is capable of giving a vacuum of 27.5 inches when dealing continuously with 80,000 pounds of exhaust steam per hour if supplied with 348,000 gallons of circulating water per hour at a temperature of eighty degrees Fahrenheit.

In connection with this condenser there are installed at Motherwell two Alberger-Corliss two-stage dry vacuum pumps, one of which is capable of dealing satisfactorily with the air in the condenser when one turbine only is in operation. The dimensions of these pumps are as follows:

Diameter of steam cylinder, ten inches;

part of the district between Clydebank and Scotstoun as well as to Temple are practically finished. They are all laid in duplicate, so that in case of any accident happening to one of them the spare one can be connected immediately while the duplicate is being repaired.

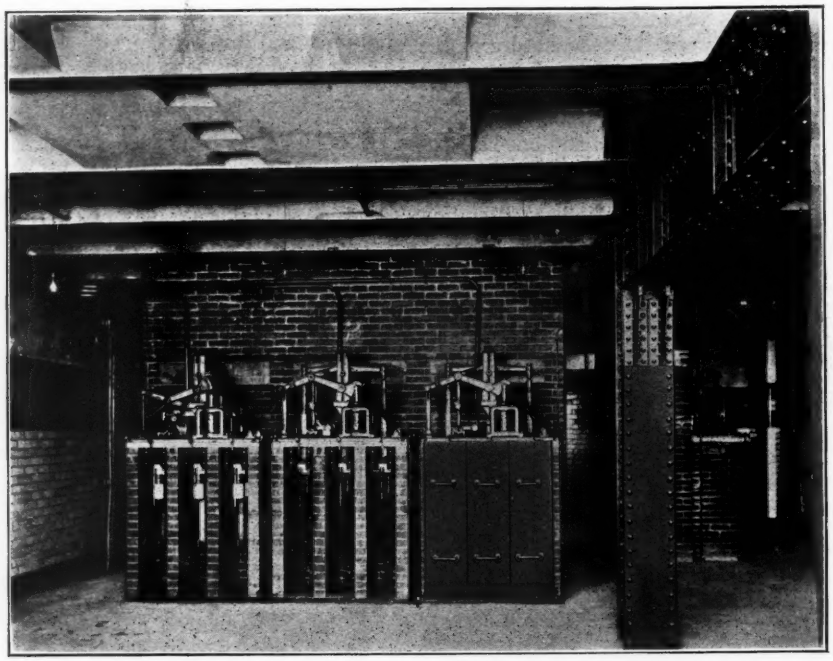
As previously stated, the Clyde Valley Electrical Power Company is authorized to supply in the adjacent burgh of Clydebank.

For this purpose a special plant has been installed at Yoker consisting of two 150-kilowatt motor-generator sets.

Each set is provided with a small motor

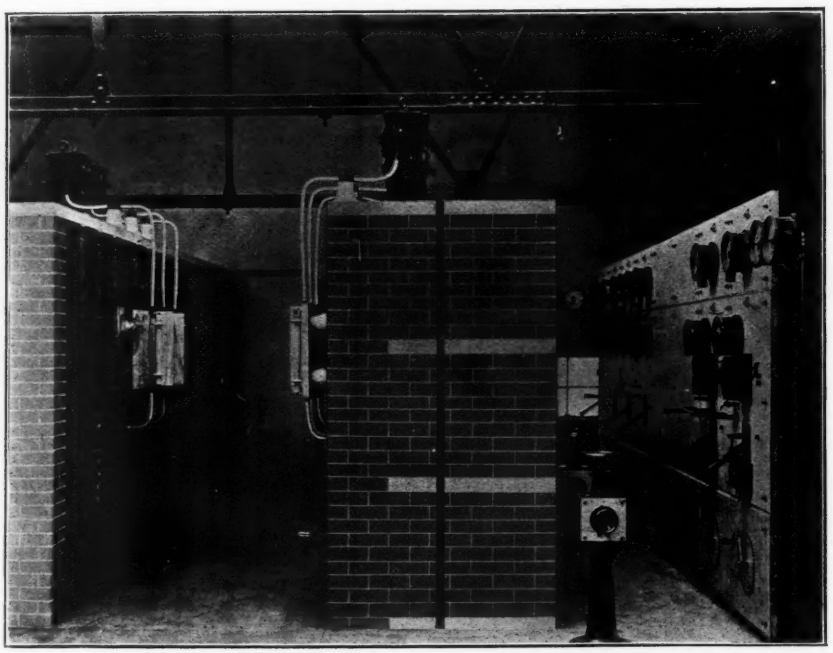
coupled direct to the shaft which serves for starting and running up to speed.

The motor-generators are situated in the first switch gallery of the Yoker power station, and the switchboard controlling the distribution to this area is placed on the top gallery.



Switch Gear, Ground Floor, Clyde Valley Electrical Power Company.

Both the high and low-tension cables for the Clydebank district were supplied and laid by Messrs. Henley & Company, and the British Insulated Wire Company has been entrusted with the extra high-tension cablework throughout the entire area.



Bus-Bar Chambers and Motor-Generator Switchboard.

The number of substations at present installed in the layout of the scheme is ten for the Motherwell district and two for Yoker.

These two districts will not at present be connected in any way, although they may be in the future.

The general arrangement of the entire plant was designed by Messrs. Strain & Robertson, consulting engineers, of Glasgow. Mr. H. A. Barnett, resident engineer of the Clyde Valley company, has had the supervision of the erection and installation of both power stations and the distribution system since the commencement.

The Electrical Hazard from the Underwriter's Viewpoint.

At the meeting of the Southwestern Electrical and Gas Association, at Denison, Tex., May 20, Mr. C. B. Roulet, chief electrical inspector of the Texas Fire Prevention Association, delivered an address entitled "The National Electrical Code and the Electrical Hazard from the Underwriter's Viewpoint." This address covered the possibility of a bad fire hazard from electrical apparatus, and rehearsed the conditions which led up to the formulating of rules by the fire underwriters, covering electrical installations. Some interesting data were submitted regarding fire losses.

During the year 1904 and the first three months of 1905, the insurance companies paid losses amounting to $4,127,000 on fires due to defective electrical installations; $19,857,000 reported due from this cause, but not definitely proven, because the fire destroyed the conclusive evidence; $2,870,000 reported due from the same cause, but which reliable investigation proved was due to other causes.

In considering the duties of the underwriter's electrical inspector, it must be borne in mind that his aim is to enforce the rules. He must require that the wires be free from contact with everything but their insulating supports, and that where they pass through woodwork, walls, etc., they should be properly bushed. This state of affairs, being obtained and retained, would almost ensure safety. The inspector must also require that all fittings such as switches, fuses, etc., be of approved makes and types, installed and protected in a proper manner. At this point the inspection ends, and the necessity of a certain amount of expert knowledge of the fire hazard begins. He must be able to judge, from his knowledge of electricity, and his experiences with the different classes of risks and other hazards, as to whether the present conditions will continue, or whether the plumber, carpenter, gas-fitter or "handy man"—those general foes of the electrician—will probably, from the location of the wires and devices, disarrange them and bring about a state of affairs which may prove hazardous. He must be able to suggest safe methods, which are also practicable and not too expensive, for accomplishing the desired end by means not provided for in the code, and when those provided for in the code can not be used. He must have sufficient knowledge and good judgment not to condemn work that he does not like the looks of simply because he does not like it. He

must be able to reason with the electrician and show him that he knows of what he speaks, and give him a good reason for his ruling and for the rules he is charged to enforce. He must believe in the code, not because he personally would, if left to himself, frame just such rules, but because he ought to know and fully believe that a code compiled by the joint efforts of the national associations, all of which are vitally interested in the industrial phases of electricity, and officially endorsed by all these associations, is far superior to any code of rules that he or any one person, no matter how expert he may be, could compile.

The National-Interstate Telephone Association.

The National-Interstate Telephone Association has established general headquarters and opened an office at 708 Electric Building, Cleveland, Ohio, with Mr. John A. Harney, assistant secretary, in charge. Files have been secured, with a view of gathering complete information on the telephone situation of the United States.

Line and circuit maps of all important toll lines in the different states, for the purpose of making up a good map of the independent development of the United States, and statistics as to the number of miles of toll lines, number of subscribers, number of exchanges and number of stockholders of the independent companies in each state are desired.

Under date of July 10 the executive council has issued notices for an assessment of one per cent per unit, as authorized at the meeting in Chicago.

Apprentices in the Electrical Trade.

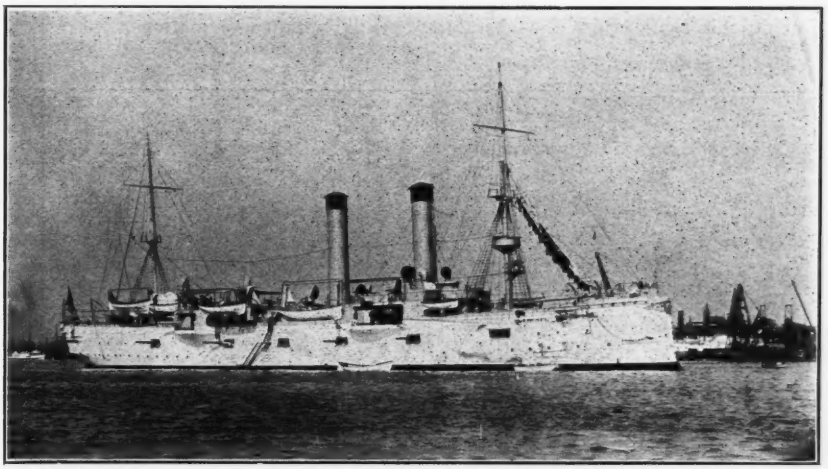
The General Electric Company announces the following rate of wages for apprentices at its factory at West Lynn, Mass.: to graduates of high schools only—drawing office apprenticeship course, $5.33 per week first six months, $6.30 second six months, $7.28 third six months, $8.25 fourth six months, $9.22 fifth six months, $10.67 sixth six months with a bonus of $75 distributed if the three years of service have been satisfactory. Shop apprenticeship course, $4.48 per week first six months, $5.60 second six months, $5.72 second year, $7.84 third year, $9.24 fourth year with a bonus of $100 at expiration of term if services have been satisfactory. For high school students and grammar school graduates—shop apprenticeship course—$3.36 per week first six months, $4.48 second six months, $5.60 second year, $7 third year, $8.40 fourth year with a bonus of $100 at expiration of term if services are satisfactory.

GOVERNMENTAL WIRELESS TELEGRAPHY ON THE PACIFIC COAST.

BY WALDON FAWCETT.

Great progress has recently been made in the extension of the United States governmental wireless telegraphy systems on the Pacific coast and in Alaska. Thorough tests have proved the value of the wireless on the western coast, and, as a result, both the war department and the navy department are energetically taking steps to broaden the scope of their operations. Indeed, optimists among government officials declare that not a great interval of time will elapse ere this country will have regular wireless communication with Hawaii.

The development of the wireless work on land is not more notable than recent achievements in the Pacific squadron, on several vessels of which wireless stations were recently established. Indeed, it was the records made by these floating installations that induced the navy department to determine upon further expansion. On the present cruise of Admiral Goodrich's fleet from Southern California to Alaska, long-distance records for the transmission of wireless messages on the Pacific coast were repeatedly broken by the operators on the flagship Chicago.



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U. S. FLAGSHIP "CHICAGO," FLAGSHIP OF THE PACIFIC SQUADRON.

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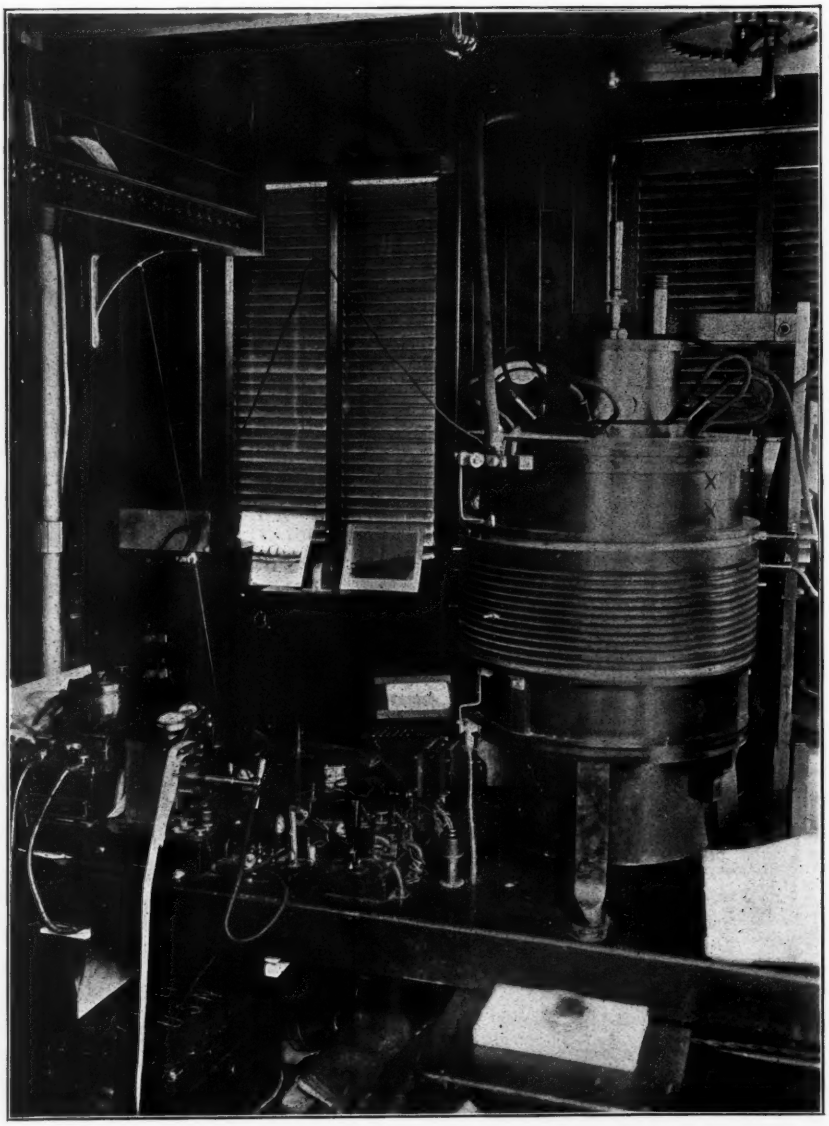
WIRELESS TELEGRAPH OPERATORS, U. S. FLAGSHIP "CHICAGO."

The record performance was found in the transmission of messages to the Marconi station at the Mare Island navy yard, at San Francisco, when the war

vessel was 140 miles north of the Golden Gate, and this, too, despite the obstacle offered by the intervening coast range of mountains. The best previous record for wireless work was made in the transmission of messages a distance of ninety-five miles.

During this same cruise the operators on the flagship communicated with the operator on the Farallone Islands, the distance being ninety-five miles, and messages were exchanged with ease and accuracy. Finally, the wireless was used for all communications between the flagship and the cruiser Boston—next to the Chicago the largest vessel of the squadron, and the only other vessel of the fleet which is at present fitted with wireless apparatus. The two vessels were at times during their run up the coast more than 100 miles apart, but the officers of the respective warships were continually in communication with one another. Indeed, such a convenience did this mode of transmission prove, not only for communicating with shore stations, but also for despatching fleet orders to a vessel so far away as to make signaling by lights or flags impracticable, that recommendation is to be made that wireless stations be installed, as promptly as possible, on all the ships of the Pacific squadron.



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WIRELESS TELEGRAPH STATION ON U. S. FLAGSHIP "CHICAGO."

The navy department is also understood to have decided, as a result of tests made during the past year, to establish a chain of eight new wireless stations on the Pacific coast, located at reasonable distances from each other, and permitting continuous communication from San Diego on the south to Cape Flattery on the north. The scope and purpose of this cordon of new wireless stations will correspond to that of the series of installations on the Atlantic coast for which the navy department recently placed contracts, and which will enable the transmission of wireless messages by successive stages from the New York navy yard to Key West, Fla.

The plans for the extension of naval wireless work on the western coast are the more significant when it is taken into consideration that at present there are only three installations at our Pacific coast governmental stations. The stations now in commission are at Mare Island, Goat Island and the southeast Farallone Island. From the last named point a meteorological report is transmitted to Mare Island, a distance of seventy miles, every morning. In Southern California, of course, wireless communication between the mainland and the famous Santa Catalina Island, situated about twenty miles distant, has been an established institution for some time past.

The war department is, of course, using the wireless to a greater or less extent at most of the important military posts on the Pacific coast, but decidedly the most interesting phase of its work in this sphere is found in the operation of the wireless as a feature of the important telegraph system recently established throughout Alaska by the United States Signal Corps. The new network covers the entire territory most thoroughly, and several very important links in the chain are supplied by the wireless.

For instance, there might be cited the section between St. Michael and Nome *via* Safety Harbor. Over 107 miles of this distance the government operates what is in many respects the most successful wireless system in the world. Some idea of the capacity and accomplishments of the system are afforded by the fact that the commercial messages transmitted average more than 6,000 words per day, and that during the month of May, 1905, the government collected on this outside business tolls to the amount of $13,500. It is a remarkable fact, too, that during the entire time the United States government has operated the wireless in this territory not a single mistake has been traced to the system. The instruments work to perfection, and the rates charged are comparatively low.

TELEPHONE SERVICE AND RATES IN NEW YORK.

SATISFACTORY RESULTS OF AN ENQUIRY BY THE MERCHANTS' ASSOCIATION.

In 1904 the Merchants' Association took up with the New York Telephone Company the matter of telephone service and charges in this city, with a view to bringing about a reduction of rates, in case it were found that the existing rates were excessive.

Mr. U. N. Bethell, general manager of the New York Telephone Company, defined his company's attitude in these words in a letter of April 14 to the Merchants' Association.

"We are always pleased to have a fair and intelligent enquiry made into the telephone conditions in this city and the other great cities of the world, the results invariably being helpful to us in removing prejudices and misunderstanding. I feel confident that a thorough study of the subject will lead you to the conclusion that our system is not surpassed for adequacy and efficiency, and that it is a credit to this city. I am equally confident that you will find, considering the quality of the service rendered, and the scope of the system, that our rates are reasonable in amount, and that the plan of charging each patron in accordance with the amount of service rendered to him is rational and equitable."

Several conferences followed, at which the following understanding was reached:

First—That the Merchants' Association should appoint a special committee of representative men of the highest standing, charged with the duty of making an exhaustive examination of the whole subject.

Second—That the New York Telephone Company should give the representatives of the Merchants' Association all reasonable assistance in the proposed enquiry, and afford every necessary and proper facility for intelligently prosecuting the work.

Third—That the Merchants' Association should publicly and in sufficient detail report the conditions of fact developed by the enquiry, with the conclusions of the committee and the reason therefor.

In accordance with this preliminary agreement, the president of the Merchants' Association in November appointed a committee who proceeded to gather information respecting telephone rates and conditions in other cities of the United States having a population of 50,000 or more, with a view to comparing the rates charged for telephone service in those cities and in New York.

It was found that the charges in New York were apparently higher than in any other city, that there was competitive service in a number of cities; that the rate charged for the competing service was apparently less than that charged for the Bell service; and that, in some instances, the introduction of competition had apparently caused a reduction of the local Bell company's rates.

The committee was, however, advised by its consulting experts that the relative capital investment and operating costs of telephone plants vary materially, according to varying physical conditions, their capacity for effective service, and the extent of the intercommunication provided for. The committee concluded, therefore, that a comparison of the rates prevailing in various cities afforded no sound ground for a conclusion as to the reasonableness of rates in any particular city; but that the reasonableness or unreasonableness of the charges in any city could only be determined by an analysis of the actual conditions of installation and operation, and the amount of the investment necessary under those conditions, in such city. At this stage the committee made a report recommending that the association confer further with the officials of the New York Telephone Company.

For this purpose the president of the Merchants' Association appointed the following special committee:

Clarence Whitman, chairman, J. Crawford McCreery, John C. Eames, Herman A. Metz, Frederick B. De Berard, secretary.

As a result of the conferences which followed, a definite agreement was reached with the New York Telephone Company as to an equitable basis of rates, the company consenting to open its books and to supply the committee with all necessary details of investment, gross earnings, operating expenses, and net earnings, as a preliminary to a readjustment of rates upon the agreed equitable basis, if such adjustment should be warranted by the facts disclosed by the investigation.

The special committee thereupon caused an examination of the telephone company's accounts to be made by the Audit Company, of New York, and further examined personally, and through experts, into such financial and operating details of telephone management in this and other cities as were germane to its purpose. Following this examination, the New York Telephone Company, in conformity with the agreement, prepared and put into effect new schedules of rates, adjusted to the basis accepted by the special committee and the company as equitable.

The report of the special committee, with the results of its examination and its conclusions, is given in substance below:

After numerous interviews with Mr. U. N. Bethell, general manager of the New York Telephone Company, and later with various operating officials of that and other telephone companies, and after careful study of a very complete collection of statistics and official documents relating to telephone rates and conditions in other American cities and in the principal cities of Europe, and a thorough discussion of all questions arising, your committee has reached certain conclusions which, with their reasons, are set forth below in their logical order.

Enquiry in all American cities having a population of more than 50,000 shows a wide variation in the rates charged for telephone service. A superficial view of the question of telephone rates is that a comparison of such rates in different cities would give correct deductions as to the reasonableness of rates in any given city. A closer examination of the subject, however, shows that such comparisons are quite deceptive. On careful consideration of the whole question, it becomes evident that both the general conditions and those peculiar to the telephone business differ so widely in different places that a bare comparison of rates can only be misleading and inconclusive. As is well known, outlays for labor, rent, taxes, real estate charges, etc., vary widely in different cities and countries, those in America being much higher than those in Europe, and in America those in large cities much higher than those in small cities. It is impossible here to enter into all the details regarding the many and wide differences which exist between the telephonic conditions of different cities. The subject is an extremely complex one, and the difficulty is to find factors in different places which are similar, so great are the variations in almost any item which may be selected for comparison. For example: there are differences in the quality, range and quantity of service rendered, and particularly in the methods of charging for the service. There are differences also in the number of subscribers who take different grades of service. In the eighty American cities having a population of over 50,000 the ratio of residence telephones to the total number of telephones varies from fifteen per cent to seventy-one per cent; of party line telephones to total telephones from four per cent to eighty-four per cent; of private branch exchange telephones to total telephones from one per cent to forty-one per cent; and of extension telephones to total telephones from four per cent to thirteen per cent.

Another striking difference in conditions peculiar to the telephone business between large and small cities should be mentioned. In a small city a single central station suffices for prompt intercommunication between two or three thousand users or individual stations. A single switchboard and single operator completes each connection called for, and, the area served being comparatively limited, the wire-mileage is relatively small. In large cities such simple conditions do not, and in the very nature of things can not, exist. For example, in the Borough of Manhattan, seventeen central stations are required. Each of these must not only provide for intercommunication between

the individual stations directly attached to it (the average number being over 8,000), as in the case of the single central station in a small city, but must also provide for prompt intercommunication with sixteen other central offices and over 140,000 individual stations outside its district. Thus, each central station, besides the equipment required for service within the district, must have sixteen distinct auxiliary cable systems connecting it with sixteen other districts. Every new central station that is added compels every existing central station to install additional connecting central office apparatus and an additional connecting cable system to afford intercommunication between every district of the entire system. This connecting plant, and the labor required to maintain and operate it, are not represented by any corresponding factors in a small city having but a single central station.

In view of these variable factors it is impossible to select any item of plant, which may be intelligently used, in reducing costs or charges in various places to common terms. Moreover, the telephone message varies greatly in cost in different places, for the reason that the amount of plant involved and the amount of labor required to make the message effective necessarily vary, and, therefore, the message can not be taken as a proper unit for making comparisons. Indeed, in the opinion of the committee, there is no common factor or unit of measure by means of which, through comparisons with other cities, sound conclusions as to the reasonableness or unreasonableness of the telephone rates in any given city can be reached. It is obvious that the fairness of the rates of charge in a specific city must be determined by the fair cost of service in that city, and not by the rates of other cities where the conditions are never identical and seldom equal.

This committee holds that the fair cost of service to the consumer should comprehend:

(*a*) Operating outlays necessary to the highest efficiency, including an ample allowance for replacement, and

(*b*) A reasonable return on the actual investment necessary to fullest efficiency of service, including a fair allowance for contingencies.

In its analysis the committee dismissed from consideration the stock and bond issues of the company, and sought only to ascertain the fair value of the property and the amount of working capital actually necessary to the efficient conduct of its business.

In considering the items to be included as the necessary investment of the New York Telephone Company, the following were accepted: telephone equipment, real estate, subway securities, supplies, cash, accounts and bills receivable.

The telephone equipment, consisting of switchboards and other central office plant, telephone apparatus at individual subscriber's stations, underground and aerial cables, poles, fixtures, wires, and other physical property actually used in the rendering of telephone service, and the counter assets or working capital of the company, such as cash, supplies, accounts and bills receivable, were included for obvious reasons.

The company places a conservative valuation upon its plant, and by regular and liberal charges for depreciation prevents any book inflation in that asset. As to the reasonableness of the valuation of the plant, the committee at first undertook to verify the amount shown by the books of the company by resorting to official documents showing investment per station in other great cities, but was compelled to abandon its effort in this direction because of the extreme variation in the conditions in different cities already referred to. The figures representing the investment in plant were, therefore, tested by reference to the reports and advices from its technical advisors, and were found to be reasonable and conservative.

It has been questioned whether the value of real estate holdings should properly be included in the capitalization necessary for telephone development. The reasons for its inclusion are strong, and seemingly conclusive. Buildings of a special type are required for the efficient and economical operation of a telephone system. There are distinct advantages in having the buildings of the various central stations as nearly as possible alike in their arrangement and construction. Fireproof buildings are indispensable to prevent interruption of service by fire—a contingency which would entail most serious inconvenience upon patrons. In many quarters of the city it is impossible to rent suitable places. The buildings must be specially located with reference to telephone centres, and often in localities not eligible for manufacturing or other commercial purposes. When once located, the central office becomes a point of concentration for the underground conduit and cable system, and can not be relocated without immense cost. In fact, suitable quarters can not be rented, and buildings especially constructed and located can not find a ready or profitable use for other purposes. Therefore, it is very desirable, if not absolutely indispensable, that the company own the buildings occupied by its central stations. Because of these considerations, the New York Telephone Company owns all the premises it occupies in the city except a few minor offices in the outlying sparsely settled districts, as, for example, in the old village of Westchester, now a part of New York city, and has constructed thereon fireproof buildings of the highest type, specially arranged for the conduct of a telephone business.

This committee believes, therefore, that the investment in real estate is an essential part of the capitalization necessary to the safe, efficient and economical management of the telephone system in this city.

The wires of the New York Telephone Company are by law required to be carried through underground conduits, except in some sparsely settled sections of its territory. Under the Act of 1885, a single company was required to construct all necessary conduits and rent space therein to any company operating electric wires. An independent conduit company was therefore compulsory under the provisions of the law. Underground transmission was then experimental, its success was doubtful, and the risk was great. Under these conditions it was found impossible to secure outside capital sufficient to build the conduits. The telephone, telegraph and electric companies were therefore compelled to supply the needed capital. As the New York Telephone Company was required by law to place its wires underground, and at the same time was in effect inhibited by law from building an underground system of its own, its capital investment in the needed underground equipment took the form of a subscription to the securities of the subway company. This investment, therefore, represents the permanent outlay for part of the permanent plant required for telephone operation in this city. It is therefore included in the necessary investment.

The gross earnings considered by the committee in its analysis of the accounts and by the Audit Company in its examination of the books included earnings of all kinds resulting from the operation of the telephone equipment, included in the investment accounts above mentioned, rents for space in the buildings temporarily not required by the company for its own purposes, dividends from subway securities and interest on bank balances or deposits of cash, and on bills and accounts receivable.

A grave mistake frequently made in telephone financiering is the failure to provide by sufficient rates of charge for the heavy outlays inevitable for replacement. A striking instance is the case of the former Home Telephone Company, of Baltimore. That company was organized in 1896, to provide service of the best standard at rates less than one-half those of the local Bell company. Its contracts were based upon the best equipment of that day. The rates of charge adopted were purely arbitrary, and without foundation in experience. They proved insufficient even to meet ordinary operating expenses, which steadily increased pro rata; and of course could not provide any fund for replacement of obsolete equipment.

In four years the company became insolvent, and its plant was sold to a new company. The purchaser soon found that the plant was practically obsolete, chiefly because of rapid and important advances in the art. In a recent suit, the court records of which were inspected by this committee, the president of the Maryland Telephone and Telegraph Company testified that within a year after acquiring the plant of the Home Telephone Company the new company was forced to raise $1,000,000 for replacement, and that

further investments were immediately compulsory until $2,155,000 had been expended to properly equip the system for the immediate use of about 6,000 subscribers, with reasonable provision for expansion. He stated that practically all the original plant, after being in service but five years, was disposed of as junk. This testimony was given in justification of an increase of fifty-seven per cent in the company's average rate.

In the New York telephone system improvements and changes have succeeded one another at close intervals during the entire period in which the business of exchange telephone service has existed. During the sixteen years which the committee's investigation covers, the plant has been practically rebuilt three times. At various times radical improvements have been made in cables and in switchboard systems which have involved the abandonment of plant by no means unserviceable because of its physical condition, and its replacement by plant of an improved character. Some of the central stations have been rebuilt three times within a little over ten years. Complete changes of equipment are within the public knowledge, as it is well known that the whole system was changed some years ago from an overhead "grounded circuit," or single-line system, to an underground "metallic circuit," or double-line system, and that later the entire equipment, both at central stations and at individual subscribers' stations, was changed from the magneto-call and local-battery system to the present automatic centralized battery system.

The telephone business demands a continuous accession of fresh capital to satisfactorily serve the public. Having in view the importance to the public of constant improvement and expansion and the greatest possible efficiency of telephone service, as well as the necessity of offering an attractive investment to new capital to provide for such expansion, it is the opinion of this committee that to provide a fair return on capital actually and necessarily invested, and a proper allowance for contingencies, ten per cent margin above operating outlays is a reasonable and proper margin in the telephone business. In the various movements hitherto made for the limitation by law of telephone profits, wherever the permissible percentage of profit has been dealt with, this margin has been accepted as a proper one. It has also been specified by law in the case of some other public service corporations. This conclusion was acceded to by the New York Telephone Company, and it was therefore agreed that the rates should be so readjusted as to produce a net revenue of approximately ten per cent on the actual capital necessarily invested in the business. It was further agreed that expert accountants selected by this committee should have free access to the books of the New York Telephone Company for the following purposes:

(*a*) To analyze the capital and learn the amount of capital actually employed in the operation of the company's system during 1904, and each of the preceding fifteen years.

(*b*) To ascertain the percentage of net earnings upon that capital during 1904, and the average annual percentage of net earnings to capital for the sixteen years ending December 31, 1904.

(*c*) To compute the reduction in revenue effected by the readjustment of rates.

The report of the Audit Company is given as follows:

The Merchants' Association, of New York:

Agreeably to your request we have examined the books and accounts of the Metropolitan Telephone and Telegraph Company and of its successor, the New York Telephone Company, for the sixteen years ended December 31, 1904.

We find the average percentage of net earnings to investment to be as follows:

For the fifteen years from January 1, 1889, to December 31, 1903: ten and eighty-nine hundredths per cent (10.89 per cent).

For the sixteen years from January 1, 1889, to December 31, 1904: eleven and twelve hundredths per cent (11.12 per cent).

For the year ended December 31, 1904: fourteen and sixty-four hundredths per cent (14.64 per cent).

This has been arrived at on the basis of the schedule of investment and net earnings submitted to us, as having been agreed upon by your association and the company.

The investment considered comprises the following: telephone property, subway securities, accounts and bills receivable, real estate, cash, supplies.

The average investment for the year was obtained by adding the amount at the beginning to the amount at the end and dividing by two.

The earnings considered were as follows: telephone earnings (less uncollectible accounts), income from subway securities, real estate earnings, interest on deposits and accounts receivable. From which were deducted: operating expenses, depreciation on plant, pole, wire and roof rentals, legal expenses, general administrative expenses, maintenance and reconstruction, instrument and subway rentals, damages and compensation, real estate expenses, insurance and taxes.

The average percentage of net earnings to investment for the full period was obtained by dividing the total of the yearly percentages by number of years.

The expenditures for the year 1904, as well as for the whole period, appear to have been properly distributed between capital and expenses. The important item of depreciation, considering the period as a whole, has been treated fairly by the company.

Every facility was afforded us by the officers of the company in the conduct of our examination.

Very truly yours,
THE AUDIT COMPANY, OF NEW YORK,
(Signed) E. T. PERINE,
General Manager.

NEW YORK, April 11, 1905.

The report of the special committee continues as follows:

The period of sixteen years was chosen for the audit because it witnessed the complete conversion of the plant from an overhead single-wire system to an underground metallic-circuit system, and again from the magneto-call local-battery system to the automatic centralized battery system, as well as the great development of the system from some 12,000 to over 150,000 stations.

This committee is of the opinion that, considering the entire period covered by the report of the Audit Company, including the year 1904, the net earnings of the New York Telephone Company, although liberal, have not been unreasonable nor excessively disproportionate to the cost of the service. It appeared, however, that the percentage of net earnings had been annually increasing of late, and that for the fiscal year of 1904 it reached 14.64 per cent on the capital actually employed.

Although the average for the sixteen years was more than ten per cent, the committee did not deem the actual percentage unreasonable, but believed that had the annual amount been to the same extent under ten per cent it should have been accepted by the company as satisfactory, and although it was appreciated that the results of a longer period than one year should ordinarily be considerd in determining rates for a business like that under consideration, nevertheless, as there had been an increasing percentage during the past few years and as it seemed probable that without a readjustment of rates the percentage would continue to increase rather than decrease in the future, the committee concluded that the time had arrived when the public should be given the benefit of another reduction in charges and urged the view that the reduction should be of such amount as to bring the present rate of earnings to at least a ten per cent basis. It was conceded by the company that the rates prevailing in 1904 were producing an income larger than required by sound financiering to meet necessary outlays and provide a sufficient return on the investment, and the view urged by the committee was accepted. A readjustment of rates to reduce the net revenue to the basis previously agreed upon as a reasonable one was therefore at once begun by the company, and expeditiously carried into effect. All subscribers were given the benefit of the new rates, regardless of their existing contracts at higher rates.

Under the heading of "Readjustment and Distribution of Rates" the report exhaustively reviews the conditions and concludes that:

A system which exacts an average uniform charge for widely varying degrees of service is obviously inequitable to the public. The flat rate is also harmful to the public in another way. Such a rate, comprehending all classes of business users and based upon the average of wide extremes, of necessity compels small users to pay a relatively higher rate than they would pay under a graded rate based upon the cost of the service used by them, and is therefore highly burdensome to such users, and presents a formidable obstacle to the development of the telephone system.

It is true that the annual outlay of most business houses for telephone service increases with each year, and in many cases is several fold larger than in former years. But it has been demonstrated above that the aggregate net revenues of the telephone company are not excessive,

and, therefore, that the rates of charge as a whole bear a fair proportion to the cost of the service; and also that relatively the larger proportion of the net profit is derived from the charges paid by small users.

Under the heading "Adequacy and Efficiency of Service," the committee reports as follows:

Ten years ago there were but 12,000 telephones in Manhattan and The Bronx. To-day there are more than 150,000. It is self-evident that the increase in number has vastly increased the utility of the system, for the usefulness of a telephone system depends primarily upon the extent to which it affords intercommunication. From this point of view, the correctness of which can not be gainsaid, the New York service is the most valuable in the world. The system is by far the largest in existence, and is much larger than those of European cities of greater population. It is larger by nearly fifty per cent than the systems of Berlin and Paris combined, and nearly as large as those of Berlin and London combined.

The table below shows the relative development of the telephone systems of New York and of the principal European capitals, and clearly proves that the telephone service here has reached much higher development in proportion to the population than in any of the great cities of Europe, and that the development of the New York system is progressing at a greater rate than that of any of the European systems.

City.	Population. Latest Census or Reliable Estimate.	Telephones. Year 1904.	Telephones per 1,000 Inhabitants.	Increase in Telephones. 1904.
London	6,580,000	93,598	14 2	16.716
Paris	2,660,000	49,444	18.5	3.981
Berlin	1.931,000	66,744	34 5	4,859
Vienna	1,762,000	21,723	12.1	2,914
Manhattan and Bronx	2,216,700	144,353	65.1	22,418

NOTE—London has two telephone systems which are operated under uniform rates and with intercommunication. The figures for London include both systems; they will eventually be consolidated into one.

In the opinion of this committee, the main factors which have operated to cause this great and continuous development of the telephone system in New York have been efficient service and the graded scale of rates.

The message rate plan was adopted in 1894. At that time the system contained a total of 11,628 stations, and was increasing at a comparatively slow rate. With the introduction of the message rates, the number of telephones in use began to increase rapidly, and during the past few years the system has increased at the rate of about 25,000 stations per year. These remarkable figures show that the message rate plan of charging for telephone service has appealed strongly to the general public.

In the extent of intercommunication, both absolutely and in proportion to the population, New York leads the large cities of the world, and therefore represents the highest potential utility.

The highest efficiency requires a physical equipment of the most improved type, sufficient in extent to enable prompt connection in response to every call, an operating force able to handle the maximum traffic without delay, and a maintenance force able to constantly maintain the plant in excellent order and quickly remove such unavoidable troubles as may appear. These essentials are found in a notable degree in the management of the New York Telephone Company. The company seems to appreciate that without them it would be sacrificing its own commercial welfare.

As to the general efficiency and superiority of the equipment and service in New York, there is much reliable and unbiased testimony.

The committee made a personal inspection of all the company's central stations in Manhattan, and carefully observed the working of the system. In its opinion the operating organization of the company is highly efficient. The operators are chosen with great care, thoroughly trained in a school maintained for the purpose, subject to admirable discipline, and, to secure undeviating attention to duty, are under the constant direction of supervisors. The utmost promptitude of service is thereby secured. In the selection of operators, good education, high intelligence, quickness, and good character are required. A very large portion of applicants are rejected forthwith; others are subjected to tests as to education and intelligence, after which a careful personal investigation as to character is made in every instance. As a result, about ninety per cent of the applicants are rejected, and but about ten per cent are given an opportunity to prove their fitness.

Comfortable and attractive sitting rooms of large size are provided in every central station, also well-equipped lunch rooms, where coffee, tea, sugar and milk are supplied without charge. The operating rooms are, without exception, large, light and airy, and ventilated by mechanical means, so that the air is always pure and cool.

In the opinion of this committee, competition in telephone service is not a public benefit, and not a useful means of regulating telephone charges. Little or no benefit accrues to any part of the public in the way of reduced rates, many consumers are compelled to increase their aggregate outlay, the utility of the service is cut in half, expansion made difficult, the efficiency of the service threatened and the capital investment endangered. Competition in telephone service does not offer a choice of benefits, but compels a choice of evils—either a half-service or a double price.

In 1897 and 1898 there were propositions before the legislature of this state for the fixing of a flat rate by law. If telephone rates had at that time been regulated by law as proposed, the result would have been most detrimental. The principle of message charges was then in the infancy of its application. A compulsory return to the principle of flat rates would have precluded the use of properly graded charges, which experience has since shown to be immensely promotive of telephone development, beneficial to users, and productive of a much smaller average charge than could have prevailed under the flat rates proposed in 1897 and 1898. The enormous development of the telephone system in the Borough of Manhattan and the successive reductions in cost to users which have resulted from the free application of the system of graded charges unimpeded by arbitrary legislative enactments is shown by the following table:

Year.	No. of Telephones.	2,400 Messages.	1,200 Messages.	Minimum.
1894, June	11,054	$240	$166	$150
1894, November	11,251	240	166	120
1895, June	12 820	200	132	90
1897, July	19,085	177	130	90
1899, June	32,196	165	111	75
1905, May	144,595	135	87	60

NOTE—The rates above relate only to business telephones. Corresponding and even greater reductions have been made in the rates for residence telephones.

All the legislation hitherto proposed containing any provision on this point has contemplated net revenues of ten per cent upon the capitalization as a fair basis of return upon the capital. It has been shown above that the earnings of the New York Telephone Company are now adjusted approximately to, and probably below, this basis. It has likewise been shown that in the past the rates of that company have been voluntarily adjusted and reduced at moderate intervals, so as to have maintained a reasonable rate of earnings during the past sixteen years; that the public have been the beneficiaries of these voluntary reductions made possible by a graded system of charges based upon sound business principles; and, further, that these reductions would have been unlikely and probably impossible had legislation arbitrarily intervened to force a continuance of the fallacious system of flat rates.

It is the belief of this committee that the regulation of telephone rates by law or intervention in the affairs of telephone companies by legislatures is undesirable so long as telephone companies afford convincing evidence of the reasonableness of their rates and show that the latter bear a proper relation to the cost of the service provided.

In the opinion of this committee, the course of the New York Telephone Company in frankly responding to a proper request for information regarding its affairs, while showing a far-sighted and intelligent regard for its own interest, is most commendable, and likely to be productive of good results in the future by establishing mutually friendly relations between the company and the public, and by removing the grounds of prejudice.

In conclusion, this committee, after

many months' study during which it has acquired due knowledge of the conditions surrounding telephone operation in this and other cities, is of the opinion that the position taken by General Manager Bethell in his letter of April 14, 1904, that the system of the New York Telephone Company is not surpassed for adequacy and efficiency, that the rates are reasonable in amount, and that the plan of charging each patron in accordance with the amount of service rendered to him, is equitable, is sustained by the facts developed by this committee's enquiry.

(Signed) CLARENCE WHITMAN,
Chairman.
J. CRAWFORD MCCREERY,
JOHN C. EAMES,
HERMAN A. METZ,
FREDERICK B. DE BERARD,
Secretary.

NEW YORK, June 23, 1905.

An Enduring National Bankruptcy System the Inherent Ally of Commerce and Credit.

On June 16, 1905, Mr. William A. Prendergast delivered an address entitled "An Enduring National Bankruptcy System the Inherent Ally of Commerce and Credit," before the National Association of Credit Men at Memphis, Tenn. The following abstracts are taken from this address:

"While in its earlier applications and uses the functions of commerce were not dependent upon a well understood or elaborated theory of credit, in its modern utilities credit is an inwrought element of the commercial system. Commerce and credit are thus the great dynamic influences which animate the activities of this mighty world.

"Bankruptcies, insolvencies, business collapses or failures—whatever we are pleased to name them—are unquestionably an inevitable outcome of commercial engagements or enterprises, and consequently, in a constantly expanding commercial environment as that which surrounds every phase of human activity today, the duty rests, not perfunctorily, but solemnly, upon those entrusted with the law-making powers of the government, to legislate not only wisely but permanently upon these questions which concern the relations of debtor and creditor and the multifarious interests represented by them.

"The history of bankruptcy legislation demonstrates that neither in principle nor in practice is it a new or untried method of controlling the many and important questions involved in its operation. It has developed in the range of its application, in the breadth of the principles of justice it exemplifies, in the humanitarian influence it dispenses, with the recurring evolutions that have signalized the thoughts and tendencies of the commercial world, during the past four hundred years. Where once it wrote servitude and despair for the unfortunate, to-day it affords hope and encouragement to him who, though unfortunate, has been honest in his misfortunes. Originally it contracted the number of those qualified to figure in business life by the penalties it imposed; to-day it extends the sphere of commerce by the freedom of action it affords the honest debtor, and the sustenance it gives the credit system, in the equity and universality of its provisions.

"It has been stated that the larger dealers only desire the law and are those who benefit thereby; also that the larger dealers are not the best barometers of public feeling either as to the utility of the law or its acceptability as a national statute. It is futile to attempt to disassociate the interests of the large and small dealers, the wholesalers, manufacturers, jobbers and retailers. In the first three classes mentioned are those who extend the great percentage of the credit of the country. Any law which protects them in their dealings with their customers, which enables them to realize the largest percentage of collections or dividends, thereby reducing losses, this character of law, is that which also enables them to sell to the retailer at a price in which the element of loss has been computed at its minimum, and what is quite as essential, a law which guards them against preferential state statutes, permits, nay encourages, freedom of credit, of which the small dealer is the beneficiary.

"The great advantages of the present law have been summarized by an eminent authority, Referee William H. Hotchkiss, of Buffalo, as follows:

1. The prevention of preferences.
2. The administration of insolvent estates wholly in charge of the creditors interested.
3. The election of the trustee by the creditors.
4. The acquirement of increased dividends from insolvent estates.
5. The adjustment of bankruptcies through compositions with the knowledge and under the direction of the court.
6. The reduction in expenses incident to failed accounts, notably in the case of attorney's fees.
7. The examination of the bankrupt by creditors.
8. The prompt administration of estates and an avoidance of the usual vexatious delays in litigation.
9. The sale of real estate clear of liens.
10. The expeditious adjudication of bankrupts, as distinguished from the tedious and expensive processes common to state courts.
11. The settlement of the affairs of corporations in bankruptcy in the interests of creditors and stockholders.
12. The use of contempt proceedings to effect the recovery of property.
13. The institution of ancillary proceedings to reach property lying in different states.
14. The excellent influence of the law in enforcing concert of action and mutual terms of settlement without recourse to legal proceedings.
15. The punishment of fraudulent bankrupts.
16. The filing of the proof of a debt without expense or the employment of an attorney, and thus, as a rule, the payment of dividends without the deduction of a collection fee. Save in questionable failures, there is no reason why a creditor should spend one farthing in advance or during administration in proving his debt or collecting his dividends.

"In bankruptcy law and practice we have to a great extent developed a new department of jurisprudence. The facility, the smoothness and the almost general satisfaction with which the law has been administered is at once a tribute to the able judges and referees who have executed it, and an unanswerable demonstration of the virility and solidity of the law itself.

"For twenty years prior to the passage of the present bankruptcy law, the friends of this character of legislation strove zealously for the success of the cause. At that time the business interests of the nation did not present the unified force in behalf of such a law as they splendidly exemplify to-day in their adherence to it.

"During the period mentioned there were sharp and powerful divisions in the ranks of the commercial army as to the wisdom and expediency of such a statute. To-day, the great business institutions of the land—which were formerly most active and potent in their hostility—are either avowed friends of the law, or reconciled to the fact that it has come to stay, and has more than responded to the best hopes of its progenitors. In all this we perceive the impregnable foundation of an enduring national bankruptcy law.

"Commerce knows no state lines. The laws which regulate commerce and govern the relations of its different factors should be as untrammeled in their operations as the spirit of commerce is unrestrained in its power and functions. The highest interests of commerce require that the citizenship of every state should sell and buy, one with the other, under conditions of absolute equality which a national bankruptcy law alone ensures."

The Pacific Coast Engineering Congress.

More than one hundred members of the Pacific Coast engineering societies gathered in the American Inn at the Lewis and Clark Exposition on June 29, at the Pacific Coast Engineering Congress held in conjunction with the ninth annual convention of the Pacific Coast Electric Transmission Association. The societies represented were the Pacific Northwest Society of Engineers, the Technical Society of the Pacific Coast, the Pacific Coast Transmission Association, the Washington State Chapter of the American Institute of Electrical Engineers, officers of the United States Corps of Engineers, engineers of the United States reclamation service and the Montana Society of Engineers. The Hon. H. W. Goode, acting in the double capacity of host and guest, welcomed the engineers to the exposition. President Goode is the chief executive of the Transmission Association, and also president of the Lewis and Clark Exposition. Mr. Goode is also president of the Portland General Electric Company. Temporary officers to conduct the congress were elected as follows: George W. Dickie, San Francisco, president; Milnor Roberts, Seattle, secretary; executive committee, Samuel Reid, Portland; George P. Low, San Francisco; Milnor Roberts, Seattle. After the address of welcome by Mr. Goode, short speeches were made by George P. Low, George W. Dickie and Frank W. Hibbs.

On Thursday morning a joint session was held and the following papers were read: "The System of the Portland General Electric Company," by F. G. Sykes; "Water Power as a Factor in Industrial Development," by Charles H. Baker.

On Thursday afternoon the following papers were read: "The Engineering Features of the Exposition," by J. R. Thompson; "Engineering and Commercial Features of the Lewiston-Clarkston System," by Allen E. Ransom; "Expositions as Engineering Educators," by G. H. Patten; "Single-Phase Railways," by M. P. Randolph.

The following papers were read on Friday, June 30: "The Cedar River Plant of the City of Seattle," by J. D. Ross; "On the Cost of Irrigation by Electrically-Driven Pumps, from Transmission Service," by W. W. Wheeler; "The Value of Sawdust as Fuel," by O. B. Cornwell. These papers were followed by "Progress," by Dr. F. A. C. Perrine; "Wrinkles," by R. W. Van Norden; and "The Question Box," by C. A. Copeland. The entertainment features included excursions to the Columbia river and a trip to Cazadero to the Clackamas river power plant of the Oregon Water Power and Railway Company.

The following officers were elected for the year; George P. Low, San Francisco, president; H. H. Sinclair, Los Angeles, vice-president; S. G. Reed, Portland, secretary.

Railroad Officials' Day at Manhattan Beach.

Following their usual custom a number of prominent railroad men and manufacturers of appliances kindred to railway operation, together with a number of invited guests made an annual pilgrimage to Manhattan Beach, New York, last week. The feature of the day was the fish dinner. Mr. H. H. Vreeland, president of the New York City Railway Company, was chairman of the arrangement committee and presided at the feast. On the committee he was assisted by W. G. Besler, vice-president and general manager of the Jersey Central; George W. West, of Middletown, superintendent of motive power of the Ontario & Western; H. S. Hayward, of Jersey City, superintendent of motive power of the Pennsylvania, and Daniel M. Brady, of New York, president of the Brady Brass Company.

After dinner the party enjoyed the performance at the Manhattan Beach theatre. In addition to the committee there were present the following:

C. L. Addison, general superintendent Long Island Railroad, Long Island City.

G. Martin Brill, president J. W. Brill Company, Philadelphia.

Newcomb Carlton, vice-president Westinghouse Electric and Manufacturing Company, New York.

R. M. Dixon, vice-president Safety Car Heating and Lighting Company, New York.

R. E. Danforth, general manager Rochester Railway Company, Rochester.

F. S. Gannon, vice-president New York City Railway Company, New York.

H. B. Hodges, purchasing agent at Long Island, Long Island City.

John Havron, president Rogers Locomotive Works, Paterson, N. J.

C. W. Huntington, general superintendent Jersey Central, Jersey City.

Frank Hedley, general manager Interborough Rapid Transit Company, New York.

George Keegan, assistant general manager Interborough Rapid Transit Company, New York.

J. R. Lovejoy, manager railway department General Electric Company, Schenectady.

John B. McDonald, New York.

R. W. Meade, president New York Transportation Company, New York.

Thomas Millen, general master mechanic New York City Railway Company, New York.

Ira A. McCormick, manager Grand Central Station, New York.

George C. Morse, Brady Brass Company, Taunton, Mass.

R. L. MacDuffie, Wendell & MacDuffie, New York.

C. C. Peirce, General Electric Company, Boston.

G. Tracy Rogers, president Binghamton Street Railway Company, Binghamton.

Oren Root, Jr., general manager New York City Railway Company, New York.

C. L. Rossiter, vice-president Long Island Loan and Trust Company, Brooklyn.

Frank C. Randall, Allis-Chalmers Company, Milwaukee, Wis.

C. A. Sterling, vice-president Public Service Corporation of New Jersey, Newark.

Edgar Van Etten, vice-president Boston & Albany, Boston.

Annual Meeting of the International Association of Municipal Electricians.

The tenth annual convention of the International Association of Municipal Electricians will be held at Erie, Pa., August 23, 24, 25, 1905.

The following papers will be presented and discussed:

"The Effects of Electrostatic Influence in Telephone and Telegraph Circuits," H. R. Allensworth, Columbus, Ohio.

"The Advisability of Fusing Fire and Police Telegraph Boxes," C. E. Diehl, Harrisburg, Pa.

"Electric Light Engineering," A. S. Hatch, Detroit, Mich.

"Erection and Maintenance of Electric Lighting Plants," C. L. Williams, Meridian, Miss.

"Suggested Improvements in Fire-Alarm Telegraph Systems," Captain Wm. Brophy, Boston, Mass.

"The Necessity of a Rigid Inspection by the Municipality," T. C. O'Hearn, Cambridge, Mass.

"Underground Construction," Louis Gascoigne, Detroit, Mich.

Power Transmission in British Columbia.

In 1898 the Vancouver Power Company was incorporated for the purpose of utilizing the power from the Coquitlam lake for generating electricity and for supplying the cities of Vancouver, New Westminster and adjoining municipalities with power, light and a general electric service. From the Coquitlam lake (432 feet above sea level) the water is conducted through a tunnel, 12,775 feet long, to Trout lake, the level of which is thirty-two feet below that of the first-named lake. The construction of the tunnel was commenced in 1903 and finished this year. Altogether 34,500 cubic yards had to be excavated, and the capacity of the tunnel is 500 cubic feet per second. Trout lake serves as a reservoir. It has an area of about 500 acres and is separated from Coquitlam lake by a range of mountains having an altitude of from 3,000 feet to 4,000 feet. It is about sixteen miles distant from Vancouver. Coquitlam lake has an area of 2,300 acres. It has a drainage area of about 100 square miles, and the annual precipitation is about 150 inches. The dam at the outlet of this lake is a rock-filled timber-crib structure, raising the water level ten feet and diverting the overflow through the tunnel. There is also a dam at Trout lake. It is of concrete fifty-four feet high and forty feet wide at its base, its length on the crest being 361 feet. The excavation was carried down to the bed-rock and necessitated the removal of 20,000 cubic yards of hard-pan and boulders. The concrete work amounts to 10,000 cubic yards and was completed within five months, Portland cement being chiefly used in its construction. Ten fifty-four-inch and two twenty-four-inch pipes, all fitted with a special design of gates and screens on the up-stream face, penetrate through the dam. At present three large pipes and one twenty-four-inch pipe extend from the dam to the power-house, 1,800 feet distant. The upper 800 feet of each line is constructed of wooden stave pipes with diameters of fifty-four inches and the lower 1,000 feet is of riveted steel construction, varying in diameter from forty-eight inches to forty-two inches at the lower ends. Ultimately the power-house is to be equipped with four 3,000-horse-power generating sets. At present, however, only three sets have been installed, the water being supplied under a static head of 400 feet. Each set consists of a three-phase sixty-cycle rotating-field Westinghouse alternator, which is coupled at either side to a Pelton wheel. The common shaft is hollow and a stream of water passes constantly through it to keep the bearings cool. In addition, each of the two bearings is provided with ring lubrication and a water jacket. The speed of the set is 200 revolutions per minute, the regulation being accomplished by Lombard governors operating deflecting needle nozzles. From the alternators the current is conveyed to air-cooled transformers in a separate concrete building, the voltage being stepped up to 20,000 volts and transmitted at this pressure to the substations at Vancouver, Burnaby, New Westminster and Lulu Island. The transmission line consists of a double line of poles. It presents a notable feature in the crossing of Burrard Inlet near the village of Barnet. The span here is 2,750 feet, the current being transmitted through steel cables, the lowest point being 150 feet above sea level. At the south end of the span are two steel towers, each 140 feet high and set on tops of a small knoll, bringing the top of the towers 300 feet above sea level. Provision has been made in the head gates at the dam and in other parts of the outworks for an ultimate utilization of 30,000 horse-power.—*Electrician (London), July* 21.

Public Ownership in Manchester.

The results of municipal ownership of street cars in Manchester, England, for the year ending March 31, 1905, were made known at a recent meeting of the tramway committee of the corporation and are made the subject of a report by Consul Walter C. Hamm, of Hull.

The report states that in 1904 the routes open for traffic aggregated 137 miles of single track. During the year just ended extensions have been made and opened for traffic, so that the average length of single track open for traffic on March 31, 1905, was 146 miles. The revenue account shows that the total income for the year was $3,159,778 and that the charges were $506,388, leaving a net profit for the year of $604,750, against $608,527 for the preceding year.

During the year the number of passengers carried was 126,900,875, an increase of over 6,000,000 on the previous year. The car mileage shows an increase of considerably over half a million miles, the figures being 14,123,124 last year, against 12,617,448 in 1903-4.

The percentage of passengers' fares shows that 71.94 per cent paid 2 cents for the journey, 11.01 per cent 3 cents, 7.10 per cent 4 cents, and 5.40 per cent 1 cent. Of the total number of passengers carried, 91,281,804 paid 2-cent fares.

The electrical energy used during the year amounted to 18,854,240 units, against 16,815,764 in the previous year. The average traffic revenue per car mile was 21.36 cents, against 21.04 cents, and the average traffic revenue per mile of single track $21,495, against $22,340 in 1903-4. The average working expenses per car mile, including power cost, was 13.98 cents, against 13.56 cents.

There has been a reduction in working hours from seventy to fifty-four hours per week. The maximum wages paid motormen is 14 cents per hour and conductors 13.50 cents per hour. A grant of one week's holiday per year with pay is given. Uniform clothing is supplied and free riding on the cars to and from duty. In Hull, which is the only instance in England of motormen receiving more than 14 cents, the pay is 15.4 cents, but there is no holiday allowance.

American Electrochemical Society.

The eighth general meeting of the American Electrochemical Society will be held at Bethlehem, Pa., September 18, 19 and 20, 1905. There will be three sessions for the reading of papers as follows: Monday, September 18, at 3 P. M.; Tuesday, September 19, at 9 A. M., and Wednesday, September 20, at 9 A. M. The sessions will be held in the lecture room of the physical laboratory of Lehigh University in South Bethlehem.

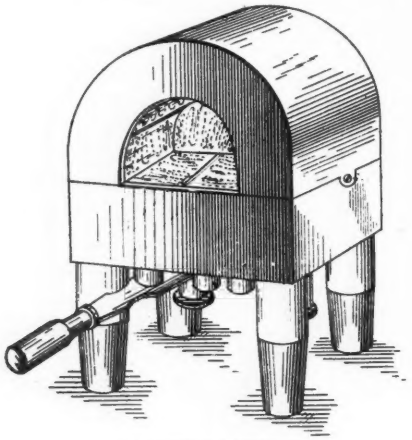
By way of entertainment a smoker will be held at one of the clubhouses at Bethlehem, on Monday, September 18, at 9 P. M. A special programme of entertainment is provided for the visiting ladies. There will be an informal reception to the ladies, with their escorts, by Professor and Mrs. J. W. Richards at their residence, 32 South Centre street, Monday evening, September 18, at 8 P. M. A lunch will be tendered to the visiting members by the authorities of Lehigh University, in the gymnasium, on Tuesday, September 19, at 12.30 P. M. A subscription dinner will be served at Eagle Hotel at 8 P. M., Tuesday, September 19.

Society of Chemical Industry.

The Society of Chemical Industry held its annual dinner in London on July 12, Dr. William H. Nichols, of New York city, presiding. Speeches were made by Lord Alverstone, Professor C. F. Chandler, of Columbia University, Sir William Huggins and others. Among the Americans present were Dr. H. W. Wiley, of the United States Department of Agriculture, and Professor Charles Baskerville, of the College of the City of New York.

Electrical Patents.

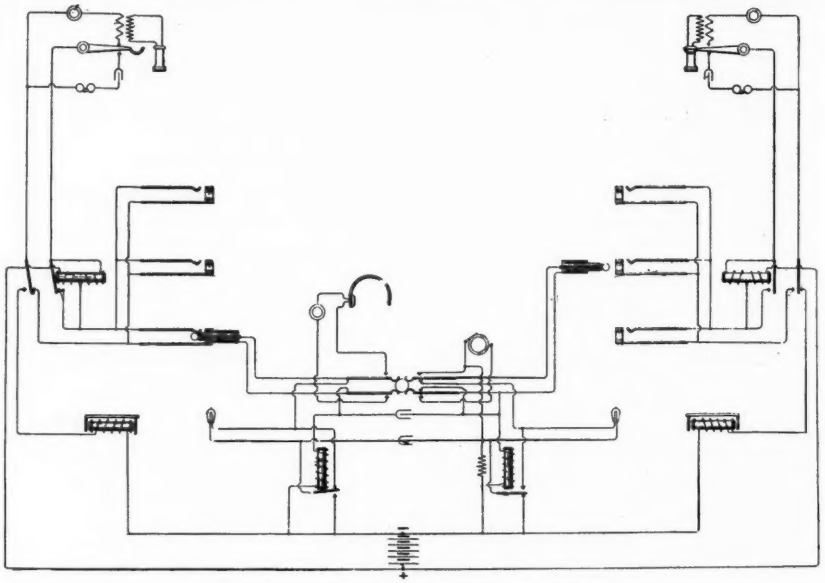
A patent on an electric oven has been granted to Levitt E. Custer, Dayton, Ohio (783,424, June 27, 1905). The invention is more especially and directly intended for that class of electrical muffles or ovens employed by dentists for the fusing of porcelain for plates, crowns, bridges and inlay work, etc., and known to the profession as "dental ovens"



ELECTRIC OVEN.

or "dental furnaces," and is an entirely separate and distinct invention over any of the many prior patents granted to Mr. Custer, but more especially over letters-patent No. 596,696, electric oven, issued on January 4, 1889. The present invention contains vastly different electrical principles and novel features of construction therefrom. In carrying out the invention, an outer separable sectional casing or shell is employed, within which is formed an interior chamber. A base is adapted to form a floor in the interior chamber and is constructed of clay and provided with means for making it elastic. A dome forms the sides and top of the interior chamber, and is also constructed of clay and provided with means for making it elastic. Electrical conductors, constructed out of high-grade wire, crimped or looped and arranged close and far apart so as to evenly distribute the heat, are provided and are embedded within the base and dome.

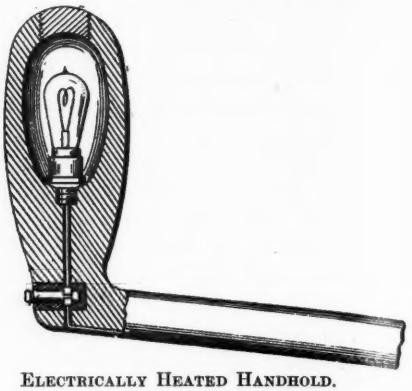
The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., controls a patent granted to Edmund Land, of Grand Rapids, Mich., on a telephone-exchange system (793,941, July 4, 1905). The invention relates particularly to systems in which a common source of current located at the central exchange is employed for the purpose of providing signaling currents and currents for the operation of the substation telephone apparatus. The objects of the invention are to provide an improved telephone system in which the complicated cut-off mechanism heretofore employed may be dispensed with and to provide an improved means for testing the condition of a subscriber's line to see whether or not it is in use. While the invention provides a system of great simplicity, still the apparatus is not readily subject to defective operation due to defective line insulation or leakage or other conditions giving rise to an electrical unbalancing of a telephone line. The invention comprises a telephone line extending by its limbs from a substation to an exchange. A source of current at the exchange is normally connected in bridge of the telephone line. A cut-off relay has two differential windings normally serially included in one limb of the line, armatures being employed for the relay. A line signal is normally serially included in the other limb with one of the armatures. A



TELEPHONE EXCHANGE SYSTEM (E. LAND).

cord-connecting apparatus is located at the central exchange. Switch springs are associated with the telephone line, one of the springs being normally connected with one limb of the line through one of the differential windings, the other spring being normally disconnected from the other limb of the line, the connection of the cord-connecting apparatus with the springs causing energization of the cut-off relay to attract its armature, whereby the switch spring is directly connected with the line limb through a short-circuit about the winding, and whereby the line signal is disconnected from circuit and the other switch spring connected with the other limb of the line.

An electrically heated handhold is the subject matter of a patent (795,201, July 18, 1905) granted to Fred Smith Davis, of Robertsville, S. C. The object of the invention is to provide for an operator who is exposed to the cold an electrically heated handhold, such for example as rheostat

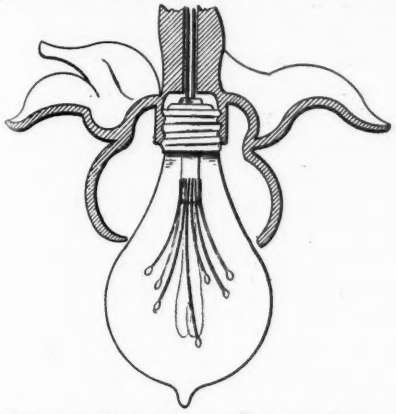


ELECTRICALLY HEATED HANDHOLD.

and brake handles on electric motor-cars or electric automobiles, pilot-wheel handles on ships, and brake handles on railway cars. The object is to do away with the ordinary handles of wood or metal and to substitute in their place a handhold electrically heated at the will of the operator to such a temperature as will ensure him having his hands comfortable even in the most severe weather. Furthermore, as the palm of the hand is a large nerve centre, such an electrically heated handhold will aid materially in keeping the operator warm. In the embodiment of the invention, the handle is provided with a hollowed-out portion, in which is located electrically operated means for heating the handle. A plug is provided for hermetically closing the handle. Insulated electric wires lead to this heating means. An insulating plug breaks the circuit through the wires, and a contact plug is

adapted to be inserted in the insulating plug to complete the circuit.

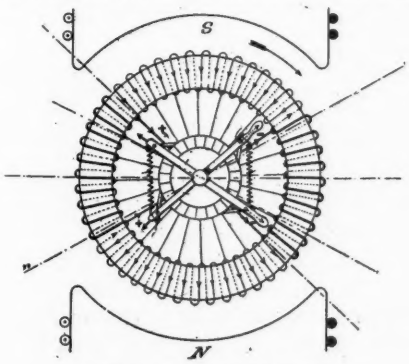
A bulb for incandescent electric lamps is the invention of Robert R. Kintz, of Meriden, Ct., who has assigned the patent obtained thereon to the Interna-



Bulb for Incandescent Electric Lamps.

tional Silver Company, of the same place (794,028, July 4, 1905). In the use of incandescent electric lamps, it is desirable that the arm or bracket in which the bulb is mounted should represent the stem of a flower and with the bulb suggest the idea of a blossom. The object of the present invention is to further carry out this idea, and it consists in arranging within the bulb a series of glass stems representing the stamens of a flower.

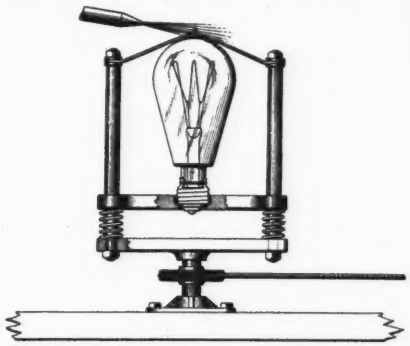
Dimitry Balachowsky, of Paris, and Phillippe Caire, of Levallois, France, are the joint inventors of a dynamo-electric machine, on which they have obtained a patent in this country (No. 794,210, dated July 11, 1905). The invention relates to improvements in such machines, whereby the demagnetizing force of the armature in these machines can be transformed into



Dynamo-Electric Machine.

a magnetizing force, the machines running without sparks. The machine comprises a field, a commutator, a double set of brushes in operative relation thereto and connected two by two and means for regulating the current through the connection. Each two connected brushes embrace a zone of commutation having the neutral point or points within the zone, whereby the demagnetizing force of the armature may be transformed into a magnetizing force to assist the field and without sparking at the brushes.

George P. McDonnell, St. Louis, Mo., has assigned to the American Electric Company, East Orange, N. J., a patent obtained by him on a method of and apparatus for finishing electric lamps or bulbs (793,211, June 27, 1905). The



Apparatus for Finishing Electric Lamps or Bulbs.

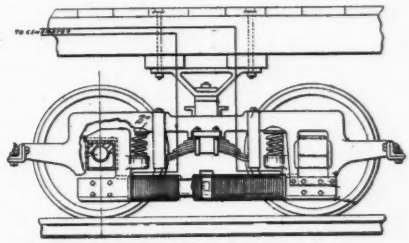
object of the invention is to remove the sharp point resulting from the closure of the tubulature. Heretofore upon closing the tubulature, the lamp or bulb was left with a projecting point, which was not only susceptible to breakage in transportation but was very brittle and frangible, and in addition was objectionable, particularly if it were accidentally struck by a person. The present invention consists in an improved method and means for eliminating this point. This method consists in first heating the lamp or bulb. The heat is then applied to the point, and the lamp or bulb is finally annealed.

Eugene C. I. Cailliez, of Lens, France, has patented (794,924, July 18, 1905) in this country an application of electric lights to revolvers or other firearms for service during night-time or in darkness. The invention consists essentially in the

Application of Electric Light to Revolver.

adaptation of an electric lamp with a reflector at the end of the barrel in connection with a battery or source of electricity situated, preferably, in the butt, which can be instantly lighted by means of a contact placed in the handle and closing the circuit. This application can be adapted to all kinds of firearms, but is especially designed for those used for personal defence, destined for firing at short distances. It reveals the object aimed at before firing, at the same time leaving the marksman in complete obscurity.

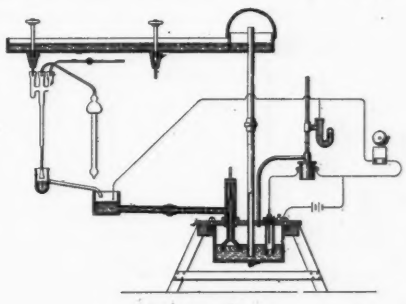
A device (794,871, July 18, 1905) for increasing the adhesion between wheels and rails is the invention of Robert C. Lowry, of Seattle, Wash. The object of the invention is to improve and simplify the construction of such devices. In carrying out the invention, a truck is employed having a plurality of wheels adapted to run upon a common rail, a magnetizable bar being fixedly supported and extending between the wheels and having pole-pieces upon its ends related to the wheels. The bar is disposed with



Device for Increasing the Adhesion between Wheels and Rails.

its pole-pieces opposite their respective wheels adjacent the point of contact thereof with the rail. An electric coil is mounted on the bar.

The Cooper Hewitt Electric Company, of New York, controls a patent (794,707, July 18, 1905) recently granted to Stanwood E. Flichtner, of Englewood, N. J., on an improvement in mercury pumps. The invention relates to improvements in mercury pumps which are adapted to create a vacuum of the desired degree of exhaustion in gas or vapor lamps of the well-known Hewitt type. The pump comprises a mercury reservoir, a mercury cir-



Mercury Pump.

cuit, and a fall-tube included in the circuit, the fall-tube being detachable and having four different diameters at different portions of its length, the uppermost diameter being comparatively large, the two next diameters being successively shortened and the lowermost diameter being larger than the contracted portion.

Reviews of Current Engineering and Scientific Literature.

Trolley Standards—Their Liability to Become Dangerous to the Public and Some Devices for Rendering Them Safe.

Mr. P. J. Pringle suggests that there has always been a difference of opinion as to the means which should be taken, in the interests of public safety, for preventing or assisting to prevent the possibility of a shock being obtained from the upper deck of a tram-car fitted with a trolley standard. There are many ways in which the trolley standard can become alive. Elaborate precautions are, as a rule, taken in all parts of a tramway system to safeguard the public against the risk of a shock, but the danger existing with a trolley standard has, to some extent, been neglected. The top deck handrail is, or should be, always earthed. It is very easy for a passenger to grip both it and the trolley standard at the same time. The iron legs of the seats are often in contact with the standard supporting the hand-railing, and a person's foot may be placed on the same while contact is made with the standard. From tests made between a live trolley standard and the metallic leg of a seat one and one-quarter inches away from the handrail, there was a potential of 430 volts. The Board of Trade has realized this danger by requiring, in its early regulations, the fitting of ruby lamps in series with the standard and earth for approximately indicating if there is any potential on the standard. The lamp, however, is only an approximate indication of the danger, and may readily be unnoticed by the conductor or motorman for a considerable time. A device has been invented by Mr. Pringle, which is now being used on the Burton-on-Trent corporation tramways, and which he considers as an absolute indication of potential on the trolley standard. The indicating and earthing apparatus is entirely enclosed in a cast-iron box. An oval window in the cover permits a red danger flag to be shown when the apparatus is at half, and also at full-cock. The earthing lead on the trolley standard is taken to an incoming terminal, which is in connection with a switch contact. A switch-blade pivoted on a screw is directly connected to earth through a solenoid attached to the back of the base-board. The solenoid is wound around an iron core, the armature being attached to its lower end. Should a leak develop in the trolley standard, and a small current, such as three or four amperes, pass to earth, this is sufficient to attract the armature and release the indicator lever, so that the apparatus falls into a half-cock position. It is held there so long as the current continues to pass through the solenoid. As soon as the indicator lever has got to the half-cock position, the red disc becomes visible and two contact springs to the left of the indicator lever are brought into contact, and ring either the electric car bell or a supplementary one. On the conductor removing the trolley from the trolley wire, the armature regains its normal position, and the indicator lever falls to full-cock, the bell circuit continuing to be rung.—*Abstracted from the Electrical Engineer (London), July* 14.

The Calcutta Electric Tramways.

The Calcutta tramway system is the largest and most important of the tramway systems in the East. Calcutta is divided into three natural parts, the European business district, the native residential and business district and the European residential district. The total population with certain adjoining suburbs is about one million, but this does not include the municipality of Howrah with a population of 157,594, nor two other suburbs which will soon come within the tramway zone, which have an additional population of 51,806, and the total population can thus be put down at one and one-quarter millions. The first tramway company was registered in England on December 23, 1880, and operated its system by steam trains on the Kidderpore section, and horse cars on the remaining section until 1901, when the original concession expired. In 1899 an agreement was entered into with the corporation whereby the company was granted a new concession for thirty years from January 1, 1901, in consideration of the conversion of the system from horse to electric traction, within three years. The electrification of the system was undertaken by Messrs. Dick, Kerr & Company of London and Preston, who carried out all the work except the buildings and the reconstruction of the permanent way, this being done by the company itself. The present tramway routes cover the total length of twenty-three miles of double track. There are eight main routes, and these, with two exceptions, can be considered city lines. The first line under electric traction in Calcutta was opened for regular service on March 27, 1902, and the entire system was operated electrically on November 20, 1902. The total number of passengers carried per year on the Calcutta tramways is 21,000,000. The total yearly train miles run, 3,300,000. The passengers per train-mile, 6.4. The average distance traveled per passenger, 2.75 miles. The average fare per passenger, 1.46 pence. Traffic operating expense per train-mile, 1.25 pence.—*Abstracted from Electrical Review (London), July* 14.

Solar and Terrestrial Changes.

It is now generally, if not universally, admitted that the sun is practically the sole source of the energy which maintains the movement of the earth's atmosphere. It is the centre of a continuous outflow of radiant energy, only a very small portion of which is intercepted and appropriated by the earth. The investigation of the rate of this flow of energy and its time variation, the analysis of the total energy into its elements as that of a series of oscillatory movements of different periods and amplitudes or wave-lengths, and the problem of its distribution in its passage through the atmosphere and at the earth's surface are each in little more than the initial stages. The appropriation of solar energy by the earth affects it mainly in two ways: first, as a whole, determining or modifying its magnetic condition; and secondly, partially affecting the atmosphere and a thin surface layer of the solid or liquid mass. Any variation in the flow of solar energy, periodic or irregular, will theoretically give rise to corresponding changes in the earth's magnetic condition and its atmospheric movements. The determination of the relations between the three classes of variation is, on the whole, the most important problem in this field of enquiry into the solar energy and its variations and effects. The first part of the problem, that is, the relation of the variations of solar energy (as manifested and measured by observable changes in the number and extent of the sun spots, prominences, etc.) to that of the magnetic condition of the earth, shown by its action on a magnetized needle suitably suspended, is comparatively small, as the earth appears to be similarly affected as a whole and throughout its whole mass. The rule is, the larger the number of sun

spots, the greater the amount of the magnetic variation and disturbance. The relation can, however, at the present stage only be considered as statistical, as it has not been established for single sun spots. In other words, the observed outburst or sudden appearance of a single spot or prominence is not invariably accompanied by a terrestrial magnetic disturbance. The problem of the relations between solar and terrestrial meteorological variations is complicated and difficult. It evidently requires for its complete solution the collection and coordination of data for the whole of the earth's surface, and the careful employment of statistical methods, regulated by thorough knowledge of the physics of the atmosphere. The observational data for a more systematic investigation are now considered by many to be sufficient, if collected, compared and discussed as a whole, to promise more satisfactory and valid conclusions than have heretofore been obtained; and perhaps a first approximate solution. This opinion found expression at the meeting of the British association at Southport in 1903. The members of the international meteorological committee present at the meeting joined in the discussion, and it was decided that the time had arrived for joint and concerted action. A commission to act as a subcommittee of the international meteorological committee was formed to discuss observations from the point of view of their connection with magnetism and solar physics. Several meetings were held at Cambridge in 1904 during the British association week. It has been arranged that a meeting of the commission shall be held in connection with the meeting of the international meteorological committee at Innsbruck in September. An important matter to be considered will be the final selection of magnetic and meteorological observatories from which data are to be collected, the mode of publication of the data received by the commission, and the methods to be employed in the work of comparison and discussion of the data.—*Abstracted from Nature (London), July* 13.

Accidents with Electrical Machinery.

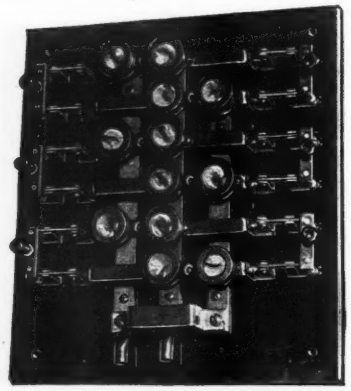
The annual report of Mr. G. Scott Ram, his Majesty's electrical inspector of factories, for the year 1904 has been issued as a parliamentary paper. This paper gives some particulars of accidents with electrical machinery. Among boiler-house accidents falls were the most numerous. Many were due to the want of proper fencing in dangerous places and to the use of temporary ladders and gangways in place of permanent and properly railed and fixed ladders. Boiler houses are frequently dangerous in this respect, owing to bad lighting. Five accidents were due to absence of protection on the gearing of mechanical stokers. Thirty-nine electrical accidents were reported in the stations of supply undertakings. These were nearly all of a severe nature, and there were three fatalities. Those occurring during ordinary routine work were mostly due to arcing of switches and fuses. One or two were primarily due to a mistake on the part of the switchman. In five cases severe burns were caused by the ignited oil from oil switches or fuses which had failed to extinguish the arc. Working on live switchboards is always attended with risk, even though, as in some of the cases reported, precautions appear to have been taken. Thus, in one case, before drilling a hole in a bus-bar, the adjacent conductors were covered with a rubber sheet which, however, was cut through by the tool accidentally slipping, thereby causing a short-circuit. In two other cases shock was guarded against by the provision of a rubber mat and the wearing of rubber gauntlets. This, however, did not prevent the accidental slipping of a pair of pliers in one case, and a spanner in the other, with consequent short-circuits. The fatal accidents occurred in the cleaning of a low-pressure, alternating-current switchboard, the pressure not exceeding 200 volts. The accidents in private electric generating stations, mostly in connection with the use of electricity for motive power, are fewer than those reported in the previous years. Arcing of switches in their ordinary use, causing in each case burns of the hand, and often of the face and arm of the operator, are generally due to faulty construction, or to the switch being too small for the work. Unprotected conductors and apparatus are, unfortunately, very common, and the only apology possible is cheapness. Faulty apparatus other than switches often result from neglect of proper testing and examination. A fatal accident was due to a leak at a pendant metal fitting. The fitting consisted of a piece of iron tube about twelve inches long, with a lamp-holder and metal shade suspended by the insulated conductors, which were attached to insulators. The current was alternating, 250 volts. The fitting was out of doors, and it was raining. The leak was probably in the lamp-holder. Had the fitting been connected to earth the accident could not have happened. Carelessness or ignorance accounts for a number of accidents. These were mostly by short-circuits, causing burns; and due to working on live conductors or switchboards. Accidents due to arcing when adjusting motor-brushes are very few when the number of motors in use is considered. During the year there were no extensive switchboard fires, although some of ordinary importance occurred. Several cable makers have taken up the question of fire-proof insulation for cables for switchboard use. Although a laboratory or workshop test can not, of necessity, be carried out under the working conditions of a large station, instructive comparisons can be made with different classes of cables on a small scale. Electrical fires sometimes appear to attain serious proportions instantaneously, but there are, no doubt, plenty of cases where they proceed gradually from small beginnings under conditions where the inflammability, or otherwise, of the insulation of the cables might readily make all the difference between disaster and a trifling breakdown. There are still many switchboards at important supply stations where the arrangement, or rather, want of arrangement, of the cables at and in the neighborhood of the switchboard appears to court disaster. The question of safety of employés is intimately connected with that of immunity from breakdown of the supply. With the enormous increase now in progress in the supply of electricity for motive power purposes in factories, the continuity and reliability of the supply becomes of more and more importance. An accident at the switchboard of a large station, causing an interruption of the supply for only a few hours, would cause an immense loss to the power users, whose factories would be at a standstill until the power supply was reinstated. One large undertaking has recently shown its appreciation of this view of the matter by replacing a switchboard, at a cost of several thousand pounds, by one of a different type, solely on account of a single accident which caused a short interruption to the supply. The fatal accidents occurring during the year happened under widely differing conditions of system and pressure, again proving that unless proper precautions are taken, any system or pressure may be dangerous. Fatal shocks occurred at pressures ranging from 10,000 to 200 volts. Some of these occurring at low pressures appeared to bring about instant death, while, in one case, at 10,000 volts death occurred after an interval of ten days, during which time the victim lost both legs and one arm by amputation, in the fruitless efforts of the surgeons to save his life.—*Abstracted from the Mechanical Engineer (London), July* 15.

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

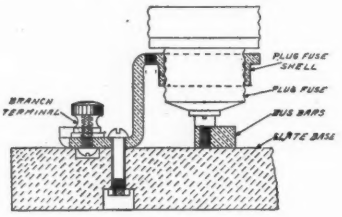
A Universal Direct-Connection Panel.

Perhaps one of the most difficult of the many annoying details of the interior wiring business is found in the con-



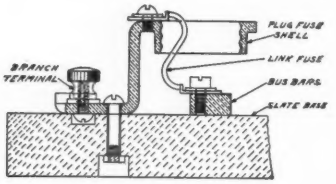
UNIVERSAL DIRECT-CONNECTION PANEL.

tractor's panel-board. There is sometimes delay in securing proper panels from the manufacturer; the use of ordinary cut-outs is at times barred because of appearances, and the necessary stock which must be carried is also a troublesome



PLUG FUSE.

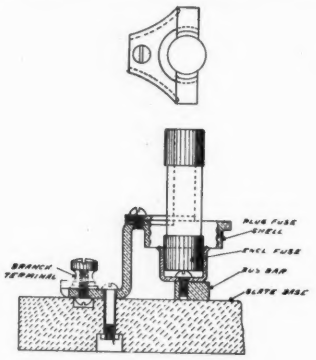
factor. Messrs. Johnson & Morton, Utica, N. Y., have recently placed on the market a new type of panel designated as the "J. & M." universal direct-connection panel, which possesses features which go far to eliminate many troublesome



LINK FUSE.

characteristics of panel-board installations. This panel can be used for two or three-wire work, with plug, link or enclosed fuses. Each tablet being adaptable, in this way it is necessary for the contractor or jobber to carry but a few sizes of each of switch and fuse panels in order for him to be able to supply from stock exactly the board required.

These boards are also of small dimensions. In their construction the circuit terminal on the switch base is carried over the bus-bar and formed into a fuse plug receptacle, so located that the fuses make direct-connection with the bus-bar. By this means the bus-bars are covered by the branch bars, and an accidental short-circuit involving the mains is practically impossible. When the fuses are removed, all of the exposed metal work, except the



ENCLOSED FUSE.

main terminals, is disconnected. The design and compact arrangement, and the small-sized cabinet necessary, have made possible a material reduction in the cost of production.

The details of the board have been carefully worked out, all parts being of the best material and workmanship.

"Interurban Railway Construction" is the title of an artistic bulletin just issued by J. G. White & Company, Incorporated.

The bulletin is illustrated with several interesting half-tone reproductions of various phases of interurban railway work, as executed by the White company. The reading matter in this bulletin describes the organization and scope of the J. G. White Company and the three associated White companies—J. G. White & Company, Limited, London, England; Waring-White Company, Limited, London, and the Canadian White Company, Limited, Montreal.

A copy will be sent to any one writing for it to the home office, J. G. White & Company, 43 Exchange Place, New York.

Railway Type Circuit-Breaker for Direct-Current Uses.

The street railway circuit-breaker shown in the accompanying illustration combines in one piece of apparatus a safety device and main switch, as it automatically opens the circuit on overload or short-circuit, and can be operated by hand to disconnect the car from the trolley circuit. It is intended to be installed over the motorman's head, in the place usually occupied by the canopy switch, but may be placed elsewhere if desired. It can be quickly closed, thus avoiding the inconvenience and delay incident to replacing a fuse.

This circuit-breaker is intended for direct-current use, and is made for capacities of 60, 100, 150 and 200 amperes, with a range from 90 per cent to 225 per cent of normal rating. The mechanism is mounted on a cast-iron base and enclosed by a pressed metal cover. The handle for resetting projects conveniently from the side of the case and the plunger for tripping by hand extends through the cover and is provided with a composition handle for the hand to strike against. The resetting handle is connected to the switch lever through a compression spring

RAILWAY TYPE DIRECT-CURRENT CIRCUIT-BREAKER.

which ensures a firm pressure and good contact regardless of the natural wear to which the parts may be subjected in service.

The arc is broken in a powerful magnetic field which effectually opens the circuit under the most severe conditions. The contacts on which the arc occurs are surrounded by a shield of insulating and arc-resisting material which prevents the

arc from being communicated to any other part of the breaker. The contact is made up of copper strips separated by spaces, each acting independently of the others, and in this way a slight irregularity or burr will affect the individual strip only without disturbing the other strips. An auxiliary contact at the end of the switch lever, which can easily be removed and replaced by a new one, serves as an arcing tip. A feature of this breaker is the accessibility when the cover is removed.

The current adjustment is made by means of a knurled head screw which engages a nut attached to a coiled spring, which in turn opposes the pull of the magnet on the armature. A trigger holds the switch in the closed position, and is in range with a projection on the armature of the tripping magnet. When the armature is drawn down by an excessive current in the coil this projection strikes the trigger and releases the switch lever which is opened instantly by a coiled spring.

The "University of Texas" Resistance Box.

The accompanying illustration shows the "University of Texas" resistance box, placed on the market by the L. E. Knott Apparatus Company, 15-17 Harcourt street, Boston, Mass. This box was designed to give the highest degree of precision of which the plug contact form of Wheatstone bridge is capable. The total range of the coils in the rheostat arm and the ratio arms is from 1 to 13,331 ohms. The one-ohm ratio coil can be thrown into either arm desired by means of one of the traveling plugs supplied with the box. An additional coil of 10,000 ohms will be provided if desired. This coil can be thrown into either the rheostat arm or the nearer ratio arm, or can be cut out altogether by means of the ordinary bridge plugs; or by the traveling plugs it can be thrown into the other ratio arm. The theoretical range of the bridge would therefore be from one-ten-thousandth ohm to 111,100,000 ohms; or, with the additional 10,000-ohm coil, one-one-thousandth ohm to 11,110,000 ohms.

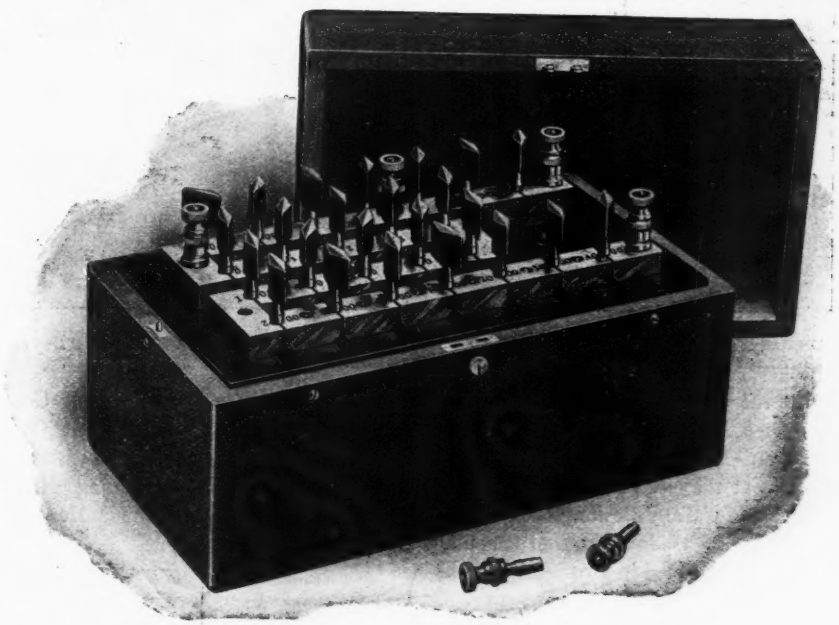
When measurements of higher precision than one-tenth per cent are wanted the ordinary modes of procedure will not suffice. With any box whatever, in its adjustment special precautions and corrections are required, and it is preferable to use a chart of corrections in such instances. The company therefore furnishes with this box a certificated chart giving the precise coil values, according to the final test made just before the instrument is sent out. With the aid of this chart, and with proper precautions, results may be secured whose precision is limited only by the inherent conditions of the plug contact box form of Wheatstone bridge.

The coils are of manganin wire, on which the effect of temperature on resistance is practically negligible over the limits of laboratory variation. The coils are wound anti-inductively on highly insulated metal bobbins of special construction, open at both ends, giving thorough ventilation from inside and outside of coils. This gives the coils a great capacity for getting rid of heat. The coils are mounted in a new manner, which makes each independent of the others, so that in case of accident a coil can be removed, readjusted and replaced without disturbing the rest. In this method of mounting each coil is elevated on short ebonite pillars.

The brass connection plugs are of liberal dimensions, with ample space cut out between for cleaning purposes. The arrangement of the blocks is on the modern approved double-bend arrangement, which brings the X-terminals at the right-hand end of the bridge, so that the box can be conveniently joined to another box, such as a subdivided ohm, or to a slide-wire. This arrangement, moreover, gives connections to the "unknown," which are of equal length and resistance. It also results in the most symmetrical and convenient grouping of the coil values.

The binding-posts are of the English pattern, taking any desired size of wire without danger of cutting. Each post is double, and has ample clamping surfaces and conductivity.

Two traveling plugs are furnished with this box. Each is double and similar in pattern to the binding-posts. Their shanks are like those of the regular bridge plugs, and fit the same holes. The bridge plugs have large diamond ebonite handles, giving a good grip and leverage. The shanks are of special shape, which prevents loss of fit by wear of the plug or holes. The shanks are of large diameter, and, being carefully fitted, give contacts of low resistance. The taper of the plugs is carefully chosen, so as to prevent wedging the blocks apart, at the same time allowing the insertion of the plugs without undue forcing.



"University of Texas" Resistance Box and Bridge.

The bridge contact is of the best obtainable ebonite. An important improvement in this box is the addition of a heavy metal girder frame securely screwed to the ebonite top. This keeps the ebonite absolutely rigid and allows of perfect alignment of the brass blocks.

The rapid loss of insulating power which follows the free exposure of ebonite to air, dust and sunlight is prevented by providing the "Texas" bridge with a mahogany box cover. This cover can be completely taken off when the box is in use, but should always be replaced when the box is not in service.

The Exhibit of the Perkins Electric Switch Manufacturing Company and the Bryant Electric Company at the Boston Exhibition.

The accompanying illustration portrays the very attractive arrangements for displaying the products of the Perkins Electric Switch Manufacturing Company and the Bryant Electric Company of Bridgeport, Ct., at the electrical exhibition held in Mechanic's Hall, Boston, Mass., July 15 to July 22. Upon a large ornamental framework embedded in a soft black background, the design illustrated was worked up in thousands of pieces of the electrical apparatus produced by these companies. The display included switches, cutouts, sockets, bases, the Perkins push-button switch, the Perkins panel switch, and double-pole switches for two and three-wire service. The booth was luxuriously decorated with palms and potted plants, and electric fans added to the comfort of the representatives and guests. Those in charge of this exhibit were Victor C. Gilpin, W. C. Bryant, E. R. Grier, Edward Patten and J. E. Way.

HEADQUARTERS OF THE PERKINS ELECTRIC SWITCH MANUFACTURING COMPANY AND THE BRYANT ELECTRIC COMPANY AT THE ELECTRICAL EXHIBITION, BOSTON, MASS., JULY 15-22.

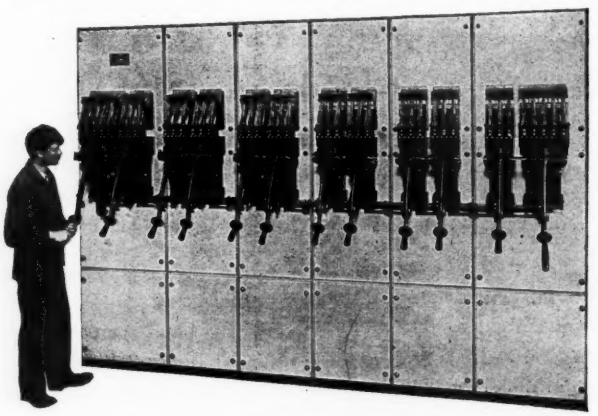
Street Car Makers Combine.

A company is being formed to acquire nineteen of the leading street car building firms in the United States. A new company will be organized with a capital of $43,000,000. The promoters are E. H. Power and W. T. Van Brunt. The companies considered are: J. G. Brill Company, John Stephenson Car Company, Laclede Car Company, St. Louis Malleable Casting Company, American Car Company, G. C. Kuhlman Car Company, Cincinnati Car Company, St Louis Car Company, Wason Manufacturing Company, Osgood, Bradley & Sons, John J. Cummings Car Company, Jewett Car Company, J. M. Jones's Sons, agents; Laconia Car Company, McGuire-Cummings Manufacturing Company, Peckham Manufacturing Company, Niles Car Manufacturing Company, Journal Bearing Company, Easy Access Door Company.

The great success of the Boer War spectacle at Brighton Beach, Brooklyn, N. Y., has prompted the Brighton Beach Company to plan extensive enlargements for the summer season of 1906. A hall of permanent industrial exhibits will be a feature which will be carried from the main entrance at the Boer War arena to Manhattan Beach. There will also be a national drama which will occupy twenty-four acres of land. Electric lighting will be used very extensively to illuminate the pike and board-walk. The Brooklyn Rapid Transit Company will build a new station and special lines will be laid connecting Coney Island with Brighton Beach.

Large Capacity Electric Motor Controller.

The illustration herewith shows the largest capacity electric motor controller ever built, being one of two designed and constructed by The Cutler-Hammer Manufacturing Company, of Milwaukee, for the Carnegie Steel Company, of Pittsburg, Pa. The panels are of white Italian marble, their total dimensions being eleven feet long and seven feet eight inches high. The first and last switches have a continuous capacity of 10,000 amperes, and the intermediate switches a continuous capacity of 6,000 amperes. The levers with which the switches are operated are a trifle over three feet long, but by means of a toggle joint action they can be easily thrown into contact. Before these two controllers were built there was but one extra large capacity controller in the United States, that being installed over a year ago in the plant of the Pittsburg Reduction Company, at Massena, N. Y. That apparatus was of 6,000 amperes capacity on first and last switches and 3,500 amperes capacity on intermediate switches and was installed on 500-volt circuit. Those for the Carnegie Steel Company will be installed on a 250-volt circuit.



LARGE CAPACITY ELECTRIC MOTOR CONTROLLER BUILT FOR THE CARNEGIE STEEL COMPANY.

The resistance for these starters is composed of steel rails arranged in a rack nineteen feet high, thirty feet long and fourteen feet wide.

A New Fuseless Rosette.

A new specialty that has been placed on the market by the Peru Electric Manufacturing Company, Peru, Ind., is the No. 7422 fuseless rosette, illustrated herewith. The novel feature in this rosette

BASE OF PORCELAIN FUSELESS ROSETTE.

is its simple design, and it will be noted that there are no brass parts other than the terminals. The screws used in fastening the rosette to the ceiling hold the cap and base together, doing away with a half-turn connection as is usual with these rosettes. The "Peru" fuseless rosette is National Code standard. It is neat in

CAP OF FUSELESS ROSETTE.

appearance and the cap is provided with a cavity to accommodate a knot in the cord. The illustration shows how completely the porcelain base protects the terminals and the ease with which the rosette can be wired.

The Growth of the Turbine Business.

A significant evidence of the remarkable foothold in the power field that is being gained by the steam turbine is given by the figures for the manufacture of the well-known Westinghouse-Parsons steam turbine. During the six months ending June 30, 1905, the Westinghouse Machine Company, exclusive builder of the Westinghouse-Parsons type, has contracted for no less than 82,000 kilowatts in turbo-generating machinery. These average nearly 1,175 kilowatts capacity per turbine unit. The machines range in size from 200 kilowatts to 7,500 kilowatts. In the distribution of the machines the electric railway has claimed the largest number, averaging 1,496 kilowatts in capacity. In the order of total capacity, railway plants have required 38,900 kilowatts; lighting plants, 26,300 kilowatts; industrial plants, 12,000 kilowatts; miscellaneous installations, 4,800 kilowatts.

ELEVENTH ANNUAL CONVENTION OF THE OHIO ELECTRIC LIGHT ASSOCIATION.

PUT-IN-BAY ISLAND, AUGUST 16, 17 AND 18.

The eleventh annual convention of the Ohio Electric Light Association will be held at Hotel Victory, Put-in-Bay Island, August 16, 17 and 18, 1905. The convention will be opened by a reception and concert to be held on Tuesday evening, August 15. The regular sessions will begin at 9.30 A. M., Wednesday, August 16, and the programme will be substantially as follows:

FIRST SESSION.

President's address.

"Central Station By-Products," J. A. Bendure, Lima, Ohio.

"Notes on Use of Barriers in Alternating-Current Switchboard Construction," H. L. Wallau, Cleveland, Ohio.

"Mercury Arc Rectifier," P. D. Wagoner, Schenectady, N. Y.

SECOND SESSION, 2 P. M.

"Effect of Large Alternating-Current Motors on Plants of 1,000 Kilowatts and Less," E. H. Best, Youngstown, Ohio; Leo Phillips, New York city.

"Electric Motor Applications," J. Henry Flinck, Pittsburg, Pa.

"Conditions Under Which It Has Been Found Advantageous to Use Potential Regulators," W. E. Richards, Toledo, Ohio.

THURSDAY, AUGUST 17—FIRST SESSION, 9.30 A. M.

"Pole-Line Construction," B. L. Chase, Columbus, Ohio; E. E. Noble, Cleveland, Ohio.

Report of committee on "Cost Determination," E. J. Bechtel, Toledo, Ohio; M. C. Hull, Columbus, Ohio.

SECOND SESSION, 2 P. M.

"Methods of Selling Current as Applied to Cities of 20,000 Inhabitants," H. C. Ayres, Greenville, Ohio.

"Methods Employed in Getting New Business and Retaining Present Business When Gasoline and Natural Gas Competition Exists," W. E. Russell, Massilon, Ohio; R. L. Johnston, Akron, Ohio; J. R. Maxon, Gallipolis, Ohio.

FRIDAY, AUGUST 18—FIRST SESSION, 9.30 A. M.

"Wiring Moderate-Size Residences," J. Kermode, Cleveland, Ohio.

"Meter and Billing Records," F. E. Valentine, Piqua, Ohio; D. W. Low, Alliance, Ohio; C. E. Inman, Warren, Ohio; George Hayler, Joplin, Mo.

Election of officers.

SECOND SESSION, 2 P. M.

High efficiency in lighting units—

"The Tantalum Lamp," William Ambler, Cleveland, Ohio.

"The Nernst Lamp," E. R. Roberts, Pittsburg, Ohio.

"High Efficiency, High Candle-Power Incandescent Lamps," F. W. Wilcox, Harrison, N. J.

Question box.

THIRD SESSION, FRIDAY EVENING.

Illustrated lecture on "Illuminating Engineering," W. D. O'Ryan, Lynn, Mass., followed by banquet.

There has been provided, in addition, an elaborate programme for the entertainment of the ladies. It is substantially as follows:

Tuesday evening—Reception and band concert for all.

Wednesday morning—Trolley ride around the island and visit to the caves for the ladies.

Wednesday afternoon—Bathing and croquet.

Wednesday evening—Grand ball in honor of the ladies.

Thursday morning—Bowling, tennis and croquet for the ladies, with prizes.

Thursday afternoon—Bathing and croquet.

Thursday night—Boat ride with the band, for all in attendance.

Friday morning and afternoon—Trip to Cedar Point for the ladies.

Friday night—Ryan's illustrated lecture, followed by banquet.

Saturday morning—Play of finals in contests for prizes and distribution of prizes.

An elaborate array of prizes has been provided by the friends of the association for the ladies' contests.

Everything possible has been done to make the convention a week of profit and pleasure. The hotel has made a rate to the convention of $2.50 to $4.50 per day, depending on the location of the rooms.

The "Sarco" Quick-Make, Quick-Break Pendant Switch.

In the description of the "Sarco" quick-make, quick-break pendant switch which appeared in the ELECTRICAL REVIEW last week, it should have been stated that this switch had been approved by the local board of the National Electrical Code, but has not yet been passed by the National Board. The "Noscru" key-arm switch made by the same company—the Sarco Company, of New York—is National Electric Code standard.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

LARGE POWER-HOUSE TO BE ERECTED AT FORT WAYNE—Plans have been completed for a $1,000,000 power-house for the Fort Wayne & Wabash Valley Railroad. The plans call for a plant to produce about 10,000 horse-power.

SOUTHEASTERN RAILWAY COMPANY—The Southeastern Railway Company has filed articles of incorporation at Little Rock, Ark., with a capital stock of $3,500,000. The directors are: president, George L. Sands; vice-president, John Scullin; secretary, W. B. Smith; treasurer, C. L. Gilbert.

PADUCAH (KY.) STREET LINES SOLD—Messrs. Stone & Webster, of Boston, Mass., have bought the properties of the Steam Heating Company, of Paducah, Ky., for $1,444,000. It is said that the purchasing company expects to spend between $300,000 and $400,000 for improvements.

TELEGRAPH AND TELEPHONE MATERIALS—The deputy postmaster-general at Melbourne, Victoria, has called for a large quantity of telegraph and telephone material. Specifications are obtainable at the post office at Melbourne, Sydney, Brisbane and Adelaide. Bids must be submitted not later than August 29.

WORK ON MARYLAND WATER POWER PLANT BEGUN—Work has been started on the hydroelectric plant at Gilpin Falls on the Northeast creek near Bay View, Elkton, Md. At the site of the power-house there is a fall of 126 feet. The plant will have sufficient capacity to light nearly all the towns in Cecil County.

NEW ENGLAND TELEPHONE AND TELEGRAPH—The directors of the New England Telephone and Telegraph Company have voted to increase the capital stock of the company 30,860 shares for the purpose of providing funds for the payment of its three series of bonds due in 1906 for the extension of the property and business of the company.

COLORADO & SOUTHERN RAILWAY TO TAKE OVER ELECTRIC POWER AND LIGHT COMPANIES—It is announced that the Colorado & Southern Railway has secured an option on the property on the Colorado Electric Power Company. It is understood that the Colorado & Southern has also taken possession of the control of the La Bella Light and Power Company, at Goldfield.

WATER POWER COMPANY INCREASES STOCK—The Grand Rapids-Muskegon Water Power Electric Company has increased its capital stock from $1,000,000 to $2,000,000, and authorizes a bond issue of $5,000,000. Work is being pushed with all possible industry on the big dam across the Muskegon river, a few miles south of Big Rapids. The company expects to be able to deliver current in Grand Rapids and other cities by January 1, 1906.

LEHIGH VALLEY TRACTION—The reorganization of the Lehigh Valley Traction Company provides $1,800,000 cash. This is realized mostly from $1,830,000 new first mortgage, five per cent bonds sold to a syndicate at about ninety-three. Of this $1,800,000 cash, it is figured that about $700,000 covers receivers' certificates, other preferred claims against the company's reorganization expenses leaving nearly $1,000,000 for improvements. This sum available for improvements has not been reduced by the purchase of the $1,000,000 minority Philadelphia & Lehigh Valley Traction bonds for which about $450,000 was paid. The funds for this purchase did not come out of those in the hands of the reorganization committee. A supplementary syndicate purchased these bonds and turned them into reorganization under the terms as originally provided.

POWER COMPANY WINS CONDEMNATION CASE—The Niagara, Lockport & Ontario Power Company received a decision in the Supreme Court on July 24 in its favor to condemn land for the power transmission line. The case of the Niagara, Lockport & Ontario company against Emma A. Stanton, of Niagara Falls, and others, was a proceeding in the Supreme Court, to secure by condemnation a right of way for the power company's transmission line across the Stanton property, near Sanborn. Attorney Robert E. Drake, of Syracuse, representing the power company, obtained an order appointing a committee to appraise the property. Negotiations were broken off and an injunction was secured by the defendants restraining the commissioners and the company from proceeding with the condemnation case. The injunction was set aside and other orders were denied. The condemnation proceedings will now be pushed by the power company.

EXTENSION OF TIME GRANTED TO CONSTRUCT PUEBLA ELECTRIC LINE—A second extension of time has been granted in the concession held by Benjamin Barrios, representing the Mexico & Puebla Railway Company, for commencing work on the proposed electric road from Mexico City to Puebla. According to this amendment, which has been signed by Leär dro Fernandez, secretary of the department of communications, the survey of the route must be completed and the line located by January 17, 1906. The concession for building this road was granted August 25, 1904. On May 11, 1905, it was modified. As the concession now stands the first ten kilometres must be completed by January 17, 1907, and the remainder of the road must be built within the next ten years. Fifteen days before the surveys are begun the department of communications must be notified and at the time the work is commenced the holders must begin the payment each month of $200 to the government railway inspection fund. These payments will be made during the life of the concession. The proposed route of the line is from Mexico City, through Amecameca, touching at Cholula and into Puebla. It is expected to supply the road with such power and equipment as will enable the company to compete successfully with the Interoceanic and the Mexican. Should the San Rafael and Atlixco carry out the project for the extension of that line to Puebla, this line would also enter the field of competition. This company has never announced its intention to enter Puebla, but has declared that the road would be extended to Atlixco and that it probably would be built from there into Puebla.

BEAVER VALLEY TRACTION LINE SOLD—Officials of the Pittsburg Railways Company have concluded the purchase of the Beaver Valley Traction Company for a sum said to approximate $1,000,000. The Pittsburg Railways Company will begin at once extensions on the north and south sides of the Ohio river to connect the Beaver Valley system with Pittsburg. The Beaver Valley Traction Company was owned by Sydney L. Wright, W. Frederick Snyder, William Henry Snyder, and William Redwood Wright, of Philadelphia, although some stock was held in the Beaver Valley. The company was chartered June 29, 1891, but became a consolidation of a number of smaller lines October 1, 1900. This merger included the Beaver Valley Street Railway, Central Street Railway, People's Electric Street Railway, College and Grandview Electric Street Railway, Rochester & Monaca Electric Street Railway, and the Beaver & Vanport Electric Street Railway. The road was entirely reconstructed after the consolidation, and in 1903 the Riverview Electric Street Railway, Freedom & Conway Electric Street Railway, and the Vanport Electric Street Railway were acquired. The company has $1,500,000 capital, of which only $1,075,000 has been issued. It operates thirty-two miles of track to and through Beaver Falls, New Brighton, Rochester, Beaver, Monaca, Colonia, Freedom, Conway, Vanport, Bridgewater, Sharon, Fallston and College Hill. The Union Trust Company, of Pittsburg, is trustee for most of the bonds. The new officers are as follows: James D. Callery, president; S. LaRue Tone, vice-president; W. B. Carson, secretary; J. C. Lightfoot, Jr., assistant secretary and treasurer; and Gaylord Thompson, general manager. The Pittsburg Railways Company now has charters and rights of way for a line from Coraopolis, its present western terminus on the south side of the Ohio, to Monaca, the southern terminus of the Beaver Valley system.

TELEPHONE AND TELEGRAPH.

ANACONDA, MONT.—The new long-distance telephone line will be extended to Wisdom.

WINCHESTER, ILL.—The Bluffs Telephone Company has extended its line to Glasgow.

BETHEL, ME.—The Farmers' telephone line from Bethel to North Newry has been completed.

SPRINGFIELD, MASS.—Telephones are being placed in a number of residences in Cummington.

DELPHI FALLS, N. Y.—A telephone line between Delphi Falls and Woodstock has been placed in operation.

GREENSBORO, N. C.—The Kernersville Telephone Company has installed a 160-drop switchboard at Kernersville.

MIDDLETOWN, N. Y.—A franchise for a telephone system has been granted to the Middletown Telephone Company.

RUSHVILLE, N. Y.—The Bell Telephone Company has constructed a line connecting Rushville and Canandaigua.

JOHNSTOWN, N. Y.—The village board of Fonda has granted a street franchise to the Interstate Telephone Company.

NEW RICHLAND, MINN.—H. Jaehning has sold the New Richland telephone exchange to Milo Hodgkins, formerly of Waseca.

NEOSHO, MO.—The U-need-er Telephone Company is erecting poles for a line connecting Ritchey and Granby by way of Newtonia and Rocky Comfort.

OROVILLE, CAL.—H. H. Yard has been granted a franchise for a telephone and telegraph line. The wires are to run along the line of the Western Pacific.

MORRISTOWN, N. J.—The New York & New Jersey Telephone Company has installed at Morristown an entirely new and modern exchange and central-office system.

HARTFORD, CT.—By a vote of 105 to 99, the bill to admit independent telephone companies to do business in the state of Connecticut has been rejected in the house.

BINGHAMTON, N. Y.—It is announced that with the installation of subway conduits, the York State Telephone Company will erect a new building for use as a telephone exchange.

ALLENTOWN, PA.—A telephone line is being erected from Palm to Hosensack. The intention is to run it northward to Macungie, taking in Old Zionsville, New Zionsville and Shimersville.

HEREFORD, PA.—A telephone line will be erected from Hereford to Palm by the Delaware & Atlantic Telephone and Telegraph Company. Connections will be made with the Pennsburg exchange.

FAITH, N. C.—A new telephone company has been organized by H. C. Farmer, L. A. Raney, Dr. A. B. Goodman, Rev. J. M. L. Lyerley and J. B. McCombs. The material has arrived and will be placed at once.

CANTON, PA.—The Fairview Independent Telephone Company has its line installed, and is connected with the Canton & LeRoy Telephone Company and the Bradford County Telephone Company at West Franklin.

CRIPPLE CREEK, COL.—The Colorado Telephone Company has commenced installing in Cripple Creek the system that is now in use in Denver and Colorado Springs. The improvements will cost nearly $100,000.

MARION, IND.—Oscar L. Barger, of the Converse Telephone Company, has been granted a franchise to build a toll line from the west corporation line into the up-town district of Marion, the same to be in operation within ninety days.

FLUSHING, N. Y.—In response to repeated demands from the Business Men's Association, of Flushing, the New York & New Jersey Telephone Company has promised to put all of its trunk lines and as many of the other lines as possible underground.

CARBONDALE, ILL.—The Marion Telephone Company has begun the construction of a telephone line from Marion to the Saline County line, a distance of fourteen miles, where it will connect with the Harrisburg Telephone Company's lines.

MORGANFIELD, KY.—The Morganfield telephone franchise has been secured by the Morganfield Telephone and Telegraph Company. The company is also the owner of a franchise in Waverly. The Cumberland Telephone Company has been awarded a franchise at Sturgis.

KAUKAUNA, WIS.—Kaukauna will be provided with another telephone exchange to be built by the Fox River Valley Telephone Company, of Appleton. The company has a franchise and expects to commence work shortly. The exchange will accommodate 1,000 subscribers.

KEMMERER, WYO.—The Rocky Mountain Bell Telephone Company will construct a line to Cokeville and Kemmerer at once. The towns of Montpelier, Idaho, Carter, Freedom, Afton, Thayne, Bedford, Ashton, Smoot, Fairview, Grover and Evanston will be on the new line.

PORTLAND, ME.—The Palermo Telephone Company, a stock company, has been organized with S. E. Bowler, president; W. S. Jones, secretary; W. W. Turner, treasurer; J. R. B. Dinsmore, M. J. Nelson, W. A. Nelson, S. E. Bowler, W. S. Jones, J. W. Northup, W. W. Turner, directors.

CLAYSVILLE, W. VA.—The Claysville Telephone Company has some extensive improvements under way. At present the company has about 150 subscribers, with exchanges at East Finley, Good Intent, Beham and Taylorstown, and within a short time an exchange will be established at West Alexander.

GLENS FALLS, N. Y.—It is stated that the Commercial Union Telephone Company will begin the work of placing its wires in conduits about September 1. The time limit fixed by the last board of trustees as to when the wires in the business portion shall all be placed underground expires January 1.

DECATUR, ALA.—The Morgan County Telephone Company, an independent concern, which owns lines in other southern cities, is building a long-distance line from Decatur to Mobile, *via* Birmingham and Montgomery. The line has practically been completed from Decatur to Cullman, thirty-three miles.

NEWARK, N. J.—A telephone company has been organized at Asbury with these members: Edgar H. Smith, Harry M. Riddle, Lewis Fox, James Riddle, John H. Miller, S. A. Brestol, D. J. Smith and E. H. Moore. They propose to extend the line to Norton, Charleston, Hampton, Junction and to Glen Gardner.

COUNCIL BLUFFS, IOWA—Ten thousand telephone poles have been ordered by the new independent company and will be used on its toll lines out of Council Bluffs, extending in five directions, either as main or branch lines. The contract will soon be let for one and one-half miles of underground conduits in the city.

PENN YAN, IND.—At a meeting of the Friend Telephone Company directors for the ensuing year were elected as follows: Thomas N. Davis, James G. Alexander, John Davis, Asahel Botsford, Daniel Sutton, James G. McDonnell and Elias F. Pulver. The following officers were elected: president, Daniel Sutton; vice-president, Elias F. Pulver.

CAMDEN, N. J.—The stockholders of the Eastern Telephone and Telegraph Company have ratified the action of the board of directors in issuing $1,000,000 worth of consolidated mortgage bonds. The bonds are to bear five per cent interest, and the moneys so derived are to be used in extending the lines of the company throughout south Jersey.

WILKESBARRE, PA.—Extensive preparations are being made by the Pennsylvania Telephone Company for the betterment of its service in Wilkesbarre and vicinity. A large number of men are already at work on the contemplated improvements and as they are extensive it is probable they will not be completed until about April 1, 1906.

CUMBERLAND, MD.—An agreement has been reached whereby the Bedford County telephone system will extend its line from Mann's Choice to Buffalo Mills, to connect with the extension of the former company from Hyndman to Buffalo Mills. Many new subscribers have been secured by the Western Maryland & Hyndman Telephone Company along the line of its extension. The territory opened up by this connection is large and Cumberland will have facilities to communicate with a number of important

towns in Blair, Bedford, Somerset and Fulton counties. The Bedford County system now embraces more than 150 miles of line and it contemplates extending its system to Centreville and other points in the Cumberland valley.

WILMINGTON, N. C.—The stockholders of the Southport Telephone Company held a meeting recently, followed by a meeting of the directors, at which W. B. Cooper were elected president; Richard Dosher, vice-president, and Dr. D. I. Watson, secretary and treasurer. The company has determined to make improvements to its system.

DOVER, DEL.—The members of the board of directors of the Diamond State Telephone Company have been increased from seven to ten, in view of the recent acquisition by the company of independent telephone lines on the peninsula. The new directors are: W. R. Driver, of Philadelphia; Fred R. Owens, of Denton, Md., and W. A. Burton, of Only, Va.

JERSEY CITY, N. J.—The annual meeting of the American Union Telegraph Company, of New Jersey, was held recently and the following officers elected for the ensuing year: president, R. C. Clowry; vice-president, Thomas F. Clarke; secretary and treasurer, A. R. Brewer; directors, R. C. Clowry, B. Brooks, Thomas F. Clarke, J. B. Van Every and J. B. Bertholf.

LOGANSPORT, IND.—The Local and Long-Distance Home Telephone Company has issued its 1905 directory of subscribers containing 2,900 names in all, including city and rural telephones. The Home Telephone Company began service in April, 1902, with 600 subscribers. Subexchanges have been installed at Walton, Galveston, Young America and Lucerne.

PENN YAN, N. Y.—At the annual meeting of the Crosby-Barrington Telephone Company officers for the ensuing year and directors were elected as follows: Thomas W. Windnagles, James K. Thayer, Howard G. Fullagar, Herbert C. Ovenshire, Charles E. Guile. Officers: president, Charles E. Guile; vice-president, Howard G. Fullagar; secretary and treasurer, Herbert C. Ovenshire.

PENN YAN, N. Y.—At the annual meeting of the Dundee Telephone Company officers were elected as follows; president, Charles J. Watson; vice-president, Charles G. Howell; treasurer, Robert B. Sworts; secretary, Harry B. Harpending; manager, Samuel A. Price; directors: Arthur Besemer, Charles J. Bigelow, R. S. Wall, Charles G. Howell, Eugene Vreeland, R. B. Sworts, S. A. Price and Harry B. Harpending.

ZANESVILLE, OHIO—The Odell & Sugartree Telephone Company has elected officers as follows: James McKahan, president; Howard Milligan, vice-president; O. B. Lanning, secretary; Perry Adams, treasurer; J. P. Lanning, George Adams and H. Milligan, directors. The work of surveying and building of line was turned over to the board of directors. It is hoped that the line will be completed and ready for use in a short time.

NEW ORLEANS, LA.—The Cumberland Telephone and Telegraph Company will, it is learned, begin at once the construction of a line along the Red River Valley tracks from Shreveport to Alexandria. The contract for the poles has been let to the American Creosote Company, of New Orleans. The distance to be traversed by the new line is 122 miles, and it is estimated that it will require from 75 to 100 carloads of poles to cover the territory.

KNOXVILLE, TENN.—Judge C. D. Clark, of the United States Court, has granted an injunction to the East Tennessee Telephone Company restraining the city of Knoxville from interfering with its new work. The contention of the city is that the telephone company is operating without a franchise. Recently, as it has tried to do new work, its workmen have been arrested and fined by the city. The case will be finally disposed of at the September term of court.

BALTIMORE, MD.—The Chesapeake & Potomac Telephone Company, which recently made a reduction in its rates for private exchanges, has issued a circular announcing a more liberal policy in regard to its long-distance lines. This follows a recent circular issued by the Maryland Telephone and Telegraph Company when it opened a wide area to its long-distance service with big cuts in prevailing rates. The Chesapeake & Potomac Telephone Company, under its new schedule, discontinues the rule making a charge for appointment calls, and permits charges to be reversed when a request for this is made to the operator and the called party consents. Under the old plan an enquiry to get a particular party was charged for even if the party was not secured.

UTICA, N. Y.—The Utica Home Telephone Company is constructing for the Consolidated Water Company a telephone line from Utica City to Trenton Falls. The new line runs along the course of the pipe-line and will have seven stations besides many private telephones in the farm houses along the route. The telephones will be connected with the local exchange. The system in the city is being improved by the addition of about 10,000 additional feet of cable, which will bring into the office about 900 more lines. The new exchange which has been opened in Newport has over 100 subscribers, and the Clinton exchange has over 350 subscribers.

MOBILE, ALA.—A meeting of the board of directors of the Home Telephone Company was held recently, and the following were elected directors: P. J. Lyons, A. H. Spira, James K. Glennon, J. C. Monteith, Adam Glass, S. C. Shaffner, William Vizard, John Craft and W. H. Bryant. Mr. Craft was elected president and Mr. Bryant, vice-president. The capital stock was ordered increased from $40,000 to $350,000. The officers state that the company expects to make a number of improvements, among them the placing of its wires underground in the business quarter of the city; and the exchange in Mobile is to be connected with a national long-distance service.

PITTSTON, PA.—Stockholders of the Merchants' Telephone Company and the Newton, Ransom & Lake Winona Telephone Company held a meeting recently, when a transaction was effected whereby the former company secured control of a majority of the stock of the latter. The Merchants' Telephone Company is chartered to build a trunk line from Scranton city line to Binghamton, N. Y., along the route of the Delaware, Lackawanna & Western Railroad, and is buying up rural telephone companies along the line. Upon the completion of the work, the Merchants' system will be a connecting link for the People's Telephone Company, of Pennsylvania, and the Independent York State company. The Merchants' company has reelected directors as follows: W. J. Fowler, of Wyoming; Dr. U. E. Dornsife, of Centremoreland; W. J. Pryor, of Allentown; J. R. Jennings, of Mehoopany; H. H. Swainbank, of Wilkesbarre.

MINNEAPOLIS, MINN.—The Northwestern Telephone Exchange announces that it has plans under consideration for doubling the capacity of its plant. The growth of the telephone business of the Northwest has been rapid during the past two years, the last six months in particular showing a remarkable increase in the number of new telephones installed, Minneapolis securing more than 3,000 during the year. Recent purchases of material are on a large scale, one order calling for the earliest possible delivery of 200,000 feet of cable for Minneapolis alone. The company is also prepared to set about 40,000 telephone poles this season. Some of these poles will be used for renewals, but owing to the great number of extensions under way in Minnesota, North and South Dakota, the greater number will be utilized in extending the Northwestern system in the three states. One of the most important extensions this season is a new line connecting Little Falls and Staples and bringing them into the group of Northwestern cities reached by the company's toll lines.

SYRACUSE, N. Y.—The Independent Telephone Company, of Syracuse, which succeeds to the stock and property of the Syracuse and Columbia Telephone companies, has organized by the election of these officers: Henrick S. Holden, president; Thomas W. Finucane, of Rochester, vice-president; Albert K. Hiscock, treasurer, and Alexander H. Cowles, secretary. These, with the following, constitute the board of directors: Gates Thalheimer, John J. Cummins, Jacob Amos and Charles M. Warner, of Syracuse; G. R. Fuller, F. W. Zoller and C. F. Lomb, of Rochester, and Eugene Satterlee, of Pittsford. The company is capitalized at $1,000,000, and has voted for an issue of $3,000,000 of bonds, the proceeds of those taken up to be used in new construction and other improvement of the old plant. The details of this work have not yet been laid out, but officers of the company say that it will particularly include an extension of the subway system and a new switchboard. A mortgage, covering this proposed bond issue, has been recorded in the county clerk's office. It is given to the Trust and Deposit Company, as trustee for the bondholders.

PERSONAL MENTION.

MR. H. F. MAC GREGOR, for over twenty years connected with the Houston (Tex.) Electric Company, tendered his resignation as vice-president on July 1.

MR. E. M. O'BRIEN has resigned his position as manager of the Des Moines exchange of the Iowa Telephone Company, and has accepted the duties of general manager of the Mutual Telephone Company.

MR. H. P. YEAGER has been appointed general traffic manager of the Toledo (Ohio) Home Telephone Company, resigning as manager of the Rome (N. Y.) Home Telephone Company. Mr. Yeager is succeeded by Mr. Alfred L. Ketcham, of Rome.

MR. J. A. NORRINGTON has resigned his position as wire chief with the Central New York Telephone and Telegraph Company and has entered the employ of the Independent company of Syracuse, N. Y., where he will reside. He is succeeded by Mr. Charles P. Weaver.

MR. F. L. MOWERY has resigned as superintendent of the Newark City Street Railways to accept the position of superintendent of the thirty-five-mile interurban system running between Canton and Salem, Ohio. Mr. Mowery is succeeded by Mr. A. H. Atherton, of Newark.

MR. J. BRODIE SMITH, general manager of the Manchester (N. H.) Traction, Light and Power Company, has been elected vice-president and a director to fill the vacancy caused by the death of Mr. George Byron Chandler. Mr. Smith will continue his duties as general manager, and the work of the two offices will be combined.

MR. THOMAS E. MITTEN has been elected president of the Chicago City Railway. Mr. Mitten left the International Traction Company to become first vice-president of the Chicago company and has been acting as executive head of the company. Mr. Lawrence A. Young has been made first vice-president. Mr. James A. Spoor will continue as Mr. Mitten's chief advisor in the capacity of chairman of the executive board.

OBITUARY NOTICE.

MR. JACOB CHESTER CHAMBERLAIN, a well-known electrical engineer, died suddenly on Friday, July 28, in New York city. Mr. Chamberlain was born in India, July 3, 1860, the son of Jacob Chamberlain, M. D., D. D. In 1872 he came to America and graduated with honors from Rutgers College, New Brunswick, in 1882. In 1883 he took a post-graduate course in chemistry. In 1884 he entered the laboratory of Mr. Thomas A. Edison at Goerck street, New York city. Soon after he was engaged as an electrical engineer in the first Edison electric light station on Pearl street, New York city. During his connection with the electric light station he devised a number of improvements for locating grounds in the street feeders. In 1886 he was engaged by Mr. Henry C. Davis, then president of the Sawyer-Man Electric Company, as electrical engineer and superintendent of construction. Some of his early installations were the electric lighting of the United States capitol, the Hudson river tunnel, Metropolitan Life Insurance Company's building and several others of a like nature. About 1889 he was engaged as electrical engineer of the Julien Traction Company, at that time introducing storage battery street cars. During his connection with this company he took out a number of patents relating to improvements and developments of storage battery systems for railway work. Some of these patents relating particularly to controllers were fundamental and have since been acquired by the General Electric Company. In 1891 he developed and patented some special gears or pinions to reduce depreciation in transmitting power from the motor to the car axle. Some time in 1893 he took up work on electric launches, and during the next seven years thoroughly developed the design, construction and equipment of these boats. In 1896 he obtained entire control of the Electric Launch Company. In 1900 the Electric Boat Company bought Mr. Chamberlain's interest in the electric launch business. During the next two or three years he confined himself to private business, in the meantime collecting what is considered by authorities as one of the finest libraries of the first editions of early American authors. In the early part of 1904 he became manager of the Automatic Refrigerating Company. He had just succeeded in developing and putting the automatic refrigerating work on a practicable and reliable basis, and was arranging to push the introduction of the automatic refrigerator on the market when his fatal illness overtook him. Early in his career Mr. Chamberlain received the degree of Master of Science. He was one of the early members of the American Institute of Electrical Engineers. He was a member of the Electric Club and later became the chairman of the house committee during the height of its career. He was also a member of the Colonial Club, the Marine and Field Club, the Grolier Club and the Engineers' Club. He leaves a widow and one daughter, eight years of age.

MR. J. C. CHAMBERLAIN.

ELECTRICAL SECURITIES.

The upward improvement in prices has held steady during the week, and in many quarters predictions are heard that security prices will go with a bull movement to a new high level. There appears to be a good deal of latent enthusiasm about, and the favorable industrial and news developments are fostering and strengthening this spirit. The crop prospects are now held to be notably good, and this is another important factor, favorable to a rising and hopeful market.

ELECTRICAL SECURITIES FOR THE WEEK ENDING JULY 29.

New York:	*Closing.*
Brooklyn Rapid Transit	69⅝
Consolidated Gas	189¾
General Electric	179¾
Interborough Rapid Transit	207½
Kings County Electric	200
Manhattan Elevated	166
Metropolitan Street Railway	128
New York & New Jersey Telephone	170
Westinghouse Manufacturing Company	168½
Boston:	*Closing.*
American Telephone and Telegraph	139
Edison Electric Illuminating	243
Massachusetts Electric	61½
New England Telephone	134¾
Western Telephone and Telegraph preferred	99

The statement of the Massachusetts Electric Companies for the quarter ending June 30 is as follows: gross, $1,690,522; operating expenses, $1,085,582, leaving net of $604,940; interest and taxes, $397,657, making the net income $207,283, as compared with $162,611 for the corresponding quarter of 1904, an increase of $44,672.

The directors of the New England Telephone and Telegraph Company have increased the capital of the company to the extent of 30,860 shares to provide funds for the extension of the property and business of the company and for the payment of its third series of bonds due in 1906. Stockholders are notified that the new stock will be issued at par (100) to stock of record at the close of business August 19, in the proportion of one new share for every eight shares now outstanding. Subscriptions close September 16 and are payable 50 per cent November 16 and 50 per cent February 16.

Philadelphia:	*Closing.*
Electric Company of America	11⅝
Electric Storage Battery common	82¾
Electric Storage Battery preferred	82¾
Philadelphia Electric	8⅞
Philadelphia Rapid Transit	27¾
United Gas Improvement	95¾
Chicago:	*Closing.*
Chicago Telephone	134
Chicago Edison Light	158
Metropolitan Elevated preferred	64
National Carbon common	4
National Carbon preferred	117
Union Traction common	7
Union Traction preferred	37

National Carbon directors have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable August 15. Books close August 5 and reopen August 16.

ELECTRIC LIGHTING.

CAMPBELLSVILLE, KY.—Campbellsville has contracted for electric lights.

ALTOONA, PA.—An electric light plant has been installed at Williamsburg.

DICKSON, TENN.—The work of installing a municipal electric light plant will begin at once.

LEICESTER, MASS.—At the annual meeting of the Rawson Light and Power Company the old officers were reelected.

ST. ALBANS, VT.—The Consolidated Lighting Company is to increase the size of its plant at Montpelier. It will install a 1,000-horse-power steam turbine.

HAZLETON, PA.—The Weatherly electric light plant, which is owned by the borough, has been wrecked by the bursting of a flywheel. The loss is about $5,000.

WILLIAMSPORT, PA.—A party of Philadelphia capitalists has purchased the gas and electric light system of Lewisburg, and contemplates making some important changes.

MAGNOLIA, MISS.—The city of Magnolia has granted a franchise to J. H. Price, C. V. Ratcliffe and L. E. Schilling to erect and operate an electric light and power plant.

BRUNSWICK, MD.—The county commissioners have granted the Harpers Ferry Electric Light and Power Company permission to string wires and erect poles in the county limits.

BINGHAMTON, N. Y.—An effort is being made by the Binghamton Light, Heat and Power Company to extend its service through the villages of Lestershire and Union, and also to supply lights for the village of Endicott.

SPRINGFIELD, OHIO—The Home Lighting, Power and Heat Company has been awarded the contract for furnishing electric lights for all the county buildings for a period of five years, the contract price being seven cents a kilowatt-hour. The contract dates from August 1.

WILKESBARRE, PA.—The Lehigh Coal and Navigation Company is laying the foundation for its electric power-house at Lansford. The building will be 100 by 100 feet and will be equipped with the most modern electric machinery. The plant will supply power for the Tamaqua & Lansford Street Railway, the Lansford shops and all of the company's breakers and mines.

STAMFORD, VT.—The Stamford Light, Heat and Power Company, which was organized some time ago, chiefly for the purpose of introducing electric lighting into that town, the current to be delivered at the state line by the North Adams Gas Company, has elected these officers: president, James D. Hunter, of North Adams; vice-president, H. T. Cady, of North Adams; treasurer, Colonel F. S. Richardson, of North Adams; clerk, C. D. Houghton, of Stamford.

OGDENSBURG, N. Y.—Electric power generated at Hannawa Falls, thirty-eight miles distant, will be transmitted to Ogdensburg under a contract signed between the Ogdensburg Power and Light Company and the Hannawa Falls Water Power Company. Transmission will be through aluminum cables. The power will be used for manufacturing purposes, operating the street railway and lighting the city. Thirty thousand horse-power is available. Existing plants in Ogdensburg will be retained as auxiliaries.

MISSOULA, MONT.—In the office of the county recorder of Missoula County Theodore Bedard has filed a water appropriation paper, claiming 2,000 inches flow per second of the waters of the Clark's Ford river near Thompson Falls. It is stated that the water is to be applied to generating power, light, heat and electricity, being appropriated for the purpose of furnishing power for an electric light and power plant, and also for irrigation. It is the intention to take the water out of the river about a mile above Thompson and convey it to the plant by means of a ditch about fifty feet wide.

BANGOR, ME.—The Messalonskee Electric Company has been organized under special charter at Waterville, with a capital stock of $250,000, of which $186,500 is paid in. The officers are as follows: president, Harvey D. Eaton; vice-president, John N. Webber; treasurer, William T. Haines; clerk and assistant treasurer, Edward L. Meader; general manager, Walter S. Wyman; corporation counsel, Herbert M. Heath; directors, Harvey D. Eaton, Walter S. Wyman, John N. Webber, George Fred Terry and William M. Ayer. The new corporation takes over the present property, franchises and business in Oakland of the Oakland Electric Company which was incorporated under the general law, and also the property, franchises and business in Waterville hitherto owned by Messrs. Eaton and Wyman as a partnership.

NEW INCORPORATIONS.

DALLAS, TEX.—Bonham Gas and Electric Light Company. $100,000.

JACOBSBURG, OHIO—The People's Telephone Company. Increased from $2,000 to $4,000.

SALEM, ORE.—Clackamas Power Company, Oregon City. $25,000. Incorporators: John T. Apperson, Charles H. Dye, Harvey E. Cross and E. G. Caufield.

LITTLE ROCK, ARK.—The Texarkana Gas and Electric Light Company. Changed to Texarkana Gas and Electric Company. Capital reduced from $200,000 to $100,000.

BOSTON, MASS.—Woodville Electric Light Company. To do a general electric light business. $3,600. President, Wilbur L. Gamage; treasurer, Samuel A. Stewart, Jr.

SAN FRANCISCO, CAL.—Sierra Nevada Water and Power Company. $5,000,000. Directors: G. B. Crittenden, W. L. Stowell, R. M. Kriesser, J. O. Bradford and C. H. Allen.

COLUMBUS, OHIO—The Licing Light and Power Company, Newark. $300,000. Incorporators: Melville Gillett, Henry G. Bohl, John P. Maynard, W. G. Barthalow, J. W. Darford.

RICHMOND, VA.—The Rappahannock Electric Light and Power Company, of Fredericksburg, Va. $25,000. Incorporators: J. B. Ficklen, president; E. C. L. Ficklen, vice-president; A. D. Tapscott, secretary, all of Fredericksburg, Va.

RICHMOND, VA.—Winchester & Jordan Springs Telephone Company, Winchester, Va. $5,000. Incorporators: L. R. Fay, president, Frederick County, Va.; H. H. Baker, treasurer, Winchester, Va.; H. F. Byrd, secretary, Winchester, Va.

LITTLE ROCK, ARK.—The Mineral Belt Traction Company, of Pyatt, Ark., and Chicago, Ill. To build a line between Pyatt, Dodd City, Kingdon Springs and Lead Hill. $200,000. Incorporators: A. J. Bradford, Robert Somerville, E. W. Swarz, Neal Dodd.

JOLIET, ILL.—Joliet Power Company. To develop, manufacture, buy, sell, distribute and deal in power; to furnish light, heat and power; build and equip power-houses, distribution systems, etc. $5,000. Incorporators and first board of directors: Fred Bennitt, T. A. Mason, Cary E. Robinson, Robert Gaylord and James A. Seddon.

NEWARK, N. J.—The Manalopan Light Company. To do an electrical business. $100,000. Incorporators: Walter P. Lindsley, Caldwell; William J. Lindsley, Woodbridge; William H. Lushear, Short Hills; Benjamin L. Lawrence, Elizabeth; South R. Farrington, Perth Amboy; Henry C. Beach, Oliver W. Jackson, Newark; Thos. F. Dunigan, Woodbridge; Benjamin F. Strauss, Elizabeth.

MADISON, WIS.—Chicago & St. Paul Telegraph Company. To build, lease and operate telegraph and telephone lines from Hudson to Milwaukee and other cities in this state, between St. Paul and Stillwater, Minn., and other places in that state, and to Chicago and other places in the state of Illinois. $100,000. Incorporators: A. G. Zimmerman, Rufus B. Smith and Alfred T. Rogers.

ALBANY, N. Y.—The Ticonderoga Union Terminal Railroad Company. To operate a surface electric line from the bridge of the Rutland railroad at Addison Junction to Ticonderoga village to the Smith Lumber Company's yard. $50,000. Directors: I. Rothschild, Altus B. Adkins, Alexander H. Weed, Frank B. Wickes, Mortimer V. Drake and Frank T. Locke, of Ticonderoga, and Frank B. Gridly and Northrup R. Holmes, of Troy.

ELECTRIC RAILWAYS.

SPRINGFIELD, ILL.—The Illinois Traction Company has begun work on the construction of an interurban line from Buffalo to Mechanicsburg.

SPOKANE, WASH.—Contracts have been let by the Spokane & Inland electric road for eleven miles of grading. This takes the line into Waverly.

DAYTON, OHIO—The Dayton & Xenia Traction Company has in contemplation a connecting link between the Dayton & Xenia and Rapid Transit lines, and the work will in all probability soon be begun.

MONROE, MICH.—Mathew Slush, president of the Detroit, Monroe & Toledo Short Line, says that the line from Monroe to Dundee will surely be built this summer and that it will ultimately be extended to Tecumseh and Adrian.

MILWAUKEE, WIS.—The Madison Traction Company may extend its tracks ten miles to South Madison in the near future. The extension would accommodate a large section of Madison which heretofore has been practically without street car accommodations.

COLUMBUS, OHIO—The Scioto Valley Traction Company is pushing work on the extension of the road from Circleville to Chillicothe and expects to open that branch of the system for traffic shortly. This is the third-rail system which now operates between Columbus, San Coster and Circleville.

SHAMOKIN, PA.—New York and Philadelphia capitalists, headed by former Congressman M. H. Kulp, of Shamokin, have formulated plans for the immediate construction of the Shamokin extension of the trolley system to Sunbury. The work is to be completed in ten months at an estimated cost of $1,500,000.

KANSAS CITY, MO.—An electric line from Kansas City to run along the north bank of the Kaw river to Lawrence and then on the south side to Topeka is said to be a probability. W. R. Stubbs, of Lawrence, who is a member of the construction firm of Stubbs, Fincke & Johnson, is to build the road.

INDIANAPOLIS, IND.—The Fort Wayne, Bluffton & Marion traction line, which the Widener-Elkins Company proposes to build from Fort Wayne to Bluffton and Marion, has filed a mortgage for $400,000 in the recorder's office at Fort Wayne. The mortgage is to secure funds for the construction of the road.

YORK, PA.—In accordance with the provisions of their charter the stockholders of the York Traction Company met in Camden, N. J., in which state the charter was issued, and reelected the old directorate as follows: W. H. Lanius, Grier Hersh, W. F. Bay Stewart, George S. Billmyer, George P. Smyser, J. W. Steacy and W. A. Himes.

SYRACUSE, N. Y.—The construction of the power-house for the Rochester, Syracuse & Eastern Railroad at Lyons is progressing rapidly. The brick walls are completed and the six large boilers which will be used have arrived. The work of grading is being pushed and there is every reason to believe that the first half of the road will be completed by December 1.

LAGRANGE, IND.—The work of laying steel on the St. Joseph Valley traction line, west of Shipshewana, is being rushed. Cars will begin running to Middlebury shortly, when the company will have eighteen miles of road in operation from Lagrange west. Preliminary work looking to the construction of the road east to connect with the Toledo & Western, at Pioneer, Ohio, is being done.

BROOKLYN, N. Y.—The trolley interests controlled by August Belmont, president of the Interborough Rapid Transit Company, and Ralph Peters, president of the Long Island Railroad Company, have secured the franchise for the Jericho Turnpike trolley line in Nassau County. Under the terms of the renewal the trolley cars must be in operation by September 1, and the company must at once furnish two bonds for the proper fulfilment of its obligations.

WILMINGTON, DEL.—Announcement is made that work is to begin shortly on the Newark & Elkton Electric Railway, and that the road will be completed and in operation in a short time. It is now proposed to connect with the lines of the Wilmington City Railway Company, which already run to Newport and Stanton instead of coming directly into this city. The power plant of the new company will be located in Elkton and it is proposed to utilize water power to be furnished by the new water company recently put into operation in Maryland.

HOLLISTER, CAL.—The franchise for an electric road along the county road, the Santa Cruz County line, *via* San Juan to Hollister, has been awarded by the supervisors to J. C. Kemp Van Ee. Bond for $10,000 is to be filed for the faithful performance of the contract. Work on the road will be commenced within four months, and the road must be completed within three years. Attorney W. M. Gibson, of San Francisco, representing Van Ee, stated that work would be commenced before the time required by the franchise, and that the road would be completed within a year.

BAY CITY, MICH.—The Bay City & Caro Railway Company has been granted a franchise. The provisions of the franchise were made to suit the promoters, and the clause with reference to building a line to Caro was eliminated, as was also the proposition requiring the building of a power-house in Iowa City. The road must be completed on or before July 1, 1907, but there is no stipulation as to the route the company shall take. It is provided that the company shall expend $20,000 within one year. The intention of the company is to run straight to Saginaw and thence to Chesaning, St. Johns and other places.

ALBANY, N. Y.—The State Railroad Commission has given permission to issue bonds as follows: to the Buffalo, Lockport & Rochester Electric Railway Company, $1,000,000, for the construction of a railway from Lockport to Rochester; to the Olean Street Railway Company, $350,000, for the construction of a line from Allegany to Salamanca; to the Cortland County Traction Company, $350,000, for the construction of a railway to Homer; to the Electric Railway Company, $500,000, for the construction of new lines in Niagara Falls; to the Waverly, Sayre & Athens Traction Company, $2,000,000, for the construction of a new line, partly in New York, partly in Pennsylvania.

IOWA FALLS, IOWA—E. S. Ellsworth, of Iowa Falls, heads the Iowa Construction Company, which will build the extension of the Des Moines Short Line, to be known as the St. Paul & Des Moines. The other members of the company are associates of Mr. Ellsworth in the new line. The company will take over the equipment of the old construction company that built the line from Iowa City to Des Moines several years ago. The construction company will complete the road, including grades, tracks, bridges, depots and in fact turn over the line to the company ready for operation. It is now figured the line will be built to Mason City, if that point is selected as the northern terminus of the proposed line, by January 1 next.

ENGINEERING SOCIETIES.

PROCEEDINGS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—The proceedings of the American Institute of Electrical Engineers for July contain the following papers, read at the recent annual convention at Asheville, N. C.: "High-Power Surges in Electric Distribution Systems of Great Magnitude," C. P. Steinmetz; "Comments on Remarks Made by Colonel R. E. B. Crompton before the International Electrical Congress at St. Louis," John W. Howell; "Water Powers of the Southeastern Appalachian Region," F. A. C. Perrine; "A New Carbon Filament," John W. Howell; "Alternate-Current Machinery—Induction Alternators," William Stanley; "Note on a Simple Device for Finding the Slip of an Induction Motor," Charles A. Perkins; "Notes on the Power-Factor of the Alternating-Current Arc," G. D. Shepardson; "Eddy Currents in Large Slot-Wound Conductors," A. B. Field; "Data Relating to Electric Conductors and Cables," H. W. Fisher; "An Experimental Study of the Rise of Potential on Commercial Transmission Lines Due to Static Disturbances Caused by Switching. Grounding, Etc.," P. H. Thomas; "Constant-Current, Mercury-Arc Rectifier," C. P. Steinmetz; "Synchronous Converters and Motor-Generators," W. L. Waters; "The Organization and Administration of National Engineering Societies" (the presidential address), John W. Lieb, Jr.; "Light Electric Railways," J. R. Cravath.

INDUSTRIAL ITEMS.

THE BROWN CORLISS ENGINE COMPANY, Corliss, Wis., has secured a contract for the Corliss engine and generator for the city of Springfield, Mass.

THE EWING-MERKLE ELECTRIC COMPANY, 1106 Pine street, St. Louis, Mo., would be pleased to send a current issue of the "Everbest" magazine. This contains considerable interesting literature relating to the electrical apparatus handled by the Ewing-Merkle company.

W. H. SCHOTT, 1218 Marquette Building, Chicago, Ill., has published a handsome booklet which details the organization and work of the Citizens' Mutual Heating Company, of Terre Haute, Ind., and points out the advantages of the Schott systems of central-station heating and power plants.

THE DAYTON MANUFACTURING COMPANY, Dayton, Ohio, in bulletin No. 130 describes the Silvey storage battery systems for isolated lighting plants. The bulletin describes the setting up of the batteries and a number of typical installations showing the wiring and switchboard connections.

R. B. COREY, representing the Bossert Electric Construction Company, Utica, N. Y., for the sale of its steel outlet boxes, switch boxes and specialties in the metropolitan district, has been appointed sales representative for southern New York, Pennsylvania, New Jersey, Delaware and the District of Columbia.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., has ready for distribution bulletins No. 59, No. 63½, No. 67 and No. 78 for its perpetual catalogue. These bulletins describe, respectively, C. & H. radial-arm reversible crane controllers, dimensions of resistances for use with C. & H. "Compound" full reverse drums, dimensions of resistances for use with C. & H. non-reversible drums, and C. & H. "Compound" full reverse machine-tool controllers.

THE LONG ARM SYSTEM COMPANY, Cleveland, Ohio, has secured a contract for installing its electrically operated bulkhead doors and hatch gears on the battleships Montana and South Carolina. The two vessels are now in course of erection by the Newport News Shipbuilding and Dry Dock Company. The navy department's specifications for these warships provided that each door must be capable of operation on the spot by power or by hand from either side, all such doors to be capable of being closed by power simultaneously from an emergency station.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is distributing a bulletin descriptive of its new electric flat-iron. This flat-iron is for laundry or household use, and runs on a 95 to 125-volt circuit, consuming about 500 watts. It is equipped with the enclosed cartridge unit type of heating element. This cartridge unit consists of a resistance coil of liberal cross-section, enclosed in a metal shell. The shell is so designed that the heat is taken away as fast as it is generated. Other bulletins that the company is now distributing are No. 2153, descriptive of a candelabra adapter, permitting the use of candelabra base lamps in standard Edison base sockets; No. 2146, describing single-pole snap switches; No. 4412, describing electric hoists for building operations and general construction work, and bulletin No. 4413, describing the CQ motor.

THE CANADIAN WHITE COMPANY, LIMITED, Sovereign Bank Building, Montreal, Canada, has recently been formed to carry on an engineering and general contracting business in the Dominion of Canada. A handsome souvenir announcement has been prepared detailing the conditions of incorporation of the company and the plans for the future. The company will have upon its board and as stockholders strong, representative business men, well known throughout Canada. The company will be organized to carry on its business in the most thorough and expeditious manner. The contracting and engineering staff will be sufficient at all times to carry out promptly and efficiently all works undertaken by the company. Mr. H. C. Hitch has been engaged as superintendent of building construction. Mr. Hitch has for several years been connected with the Thompson-Starrett Company, of New York, as superintendent.

PASS & SEYMOUR, INCORPORATED, announce that it is their intention to materially increase their facilities for handling orders in the territory covered by their Chicago office, and to this end have secured the services of W. F. Hessel, formerly sales manager of the Western Electric Company at Chicago. Mr. Hessel's long experience and intimate acquaintance with the materials and needs of the electrical business is of such a character that they are pleased to announce his association with them, and wish to advise their customers to feel at liberty to call upon him at any time for information not only regarding their line of electrical specialties, but also regarding any problem of a general nature on which his past experience will be of service. Mr. Hessel's headquarters will be at No. 130 West Jackson Boulevard, Chicago, Ill.

THE MARINE ENGINE AND MACHINE COMPANY, manufacturer of electric elevators, has removed its offices to 126 Liberty street, New York city, where it occupies the entire fourth floor. This company has recently secured the following contracts: the Hutchins Building, at southeast corner of Fifth avenue and Thirty-ninth street, C. P. H. Gilbert, architect, Thompson-Starrett Company, builder, four direct-connected, electrically controlled elevators; the College of the City of New York, George B. Post, architect, Thomas Dwyer, builder, eleven electric elevators; one tandem electric elevator for the building of the New Orleans Railways, Sanderson & Porter, engineers; one electric elevator in the Hartford Building, Seventeenth street and Union square, New York city; two electric elevators for the Pennsylvania Railroad Company, at Long Island City, Westinghouse, Church, Kerr & Company, engineers; one electric elevator for the Willett Realty Company's new building at West End avenue and Eighty-second street, Carlton Strong, architect; and one automatically controlled residence lift for C. W. Luyster at 16 East Sixty-seventh street.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY has secured orders from Nelson Morris & Company for nineteen type CCL induction motors varying in sizes from five to fifty horse-power and totalling 410 horse-power, and for eight motors of the same type from the Decatur Car Wheel and Manufacturing Company, Birmingham, Ala. These are the latest design of induction motors which have been built by the company and have recently been placed on the market. On the same day an order was entered from the Illinois Steel Company for eighty direct-current motors having an aggregate capacity of 3,920 horse-power. These motors are all of the railway type and range from thirty to seventy-five horse-power. The Hawaiian Electric Company, of Honolulu, has contracted for two 1,200-kilowatt, three-phase, 2,200-volt, engine-type generators, two 125-kilowatt exciters and seven 500-kilowatt, oil-insulated, self-cooling transformers. The Rumford Falls Power Company, of Rumford Falls, Me., will install one 550-kilowatt and one 800-kilowatt alternating-current generators which will be direct-connected to water-wheels. The order includes two 450-horse-power variable-speed induction motors, and 120 type OD transformers for use on the distributing lines.

THE DE VEAU TELEPHONE MANUFACTURING COMPANY, 27 Rose street, New York, has just issued a new catalogue, the twelfth edition, on standard telephone apparatus and equipments, containing also telephone wiring diagrams. While the catalogue is not a bulky one, it shows an unusual degree of intelligence in discriminating as to what information is essential to those contemplating the installation of telephone apparatus. The illustrations and descriptions of the De Veau switchless intercommunicating systems indicate an especially durable and well-constructed line of apparatus for this service. In this new catalogue also are illustrated various types of special desk telephones for both exchange and intercommunicating work, special apparatus for apartment houses, receivers and transmitters, and various essential telephone accessories. This company now occupies nearly an entire building, and in view of its location within New York city, its skilled labor and facilities for the finest apparatus are excellent. The growth of this company is of interest, as it is said to be the first manufacturing house established for the production of "independent" telephone apparatus, and its struggles with the patent situations and the limited field for this apparatus in the early days of the art form an interesting chapter in the history of telephony.